What's in This Issue

In active charge of this country's program to rehabilitate the merchant marine is Admiral Emory S. Land pictured here at his desk in Washington

Just what is the Maritime Commission's idea for **revamping the merchant marine?** None other than Admiral Land, the commission's chairman, outlines the program in an exclusive article on page 753.

One method of getting high production from presses is by equipping them with well-designed feeding devices. C. W. Hinman, in the third of his series of articles on press working of metals, tells you on page 760 all about **manual or automatic stops and dial feeds for presses.**

If you are interested in **corrections for flat internal form tools,** you will find some helpful information on page 775. It's a part of American Machinist's Reference Book Sheet service.

Nothing requires greater skill in manufacture than **production of steel rolling mill equipment.** In that field Mesta is a leader. How Mesta does this exacting work, with ample illustrations, is described on page 754.

It is hard to sell the factory worker the idea that **greater efficiency in the shop means more pay** for him. One way of doing it is through a committee of his fellow workers. This plan is outlined on page 757.

Jones & Lamson completely **machines each unit of its machine tools in specialized small departments.** John E. Lovely, vice-president and chief engineer, brings you the details, together with pictures, on page 758.

Form tools made as separate units and clamped together to form the desired contour require fewer operations than producing the tool as an integral unit. The design of such tools is described by Fred W. Lucht of the Carboloy Company on page 770. Line drawings help to visualize the design.

A jig of novel design for drilling and tapping four holes for screws in pump parts is shown on page 773. It should interest small shop operators and maintenance men.

Does a good inspector have to be born that way? **Simple tests pick out persons qualified to pass on a company's product.** These tests are outlined on page 766. Pictures show you how the tests are made.

Are you thinking of buying **new shop equipment?** If so, we suggest that you take a look at "Shop Equipment News" starting on page 777.

Grinding non-metallic rollers is only one of the subjects treated in "Ideas From Practical Men" on page 772.

What is the row in the United Automobile Workers all about? Frank Rising, our own labor editor, gives you the lowdown in a special story on page 776.

COMING

Every shop has its tool checking problem. The ideal arrangement is one that will let the workman have what he needs quickly and still maintain a complete record of what's out and who's got it. C. H. Bornemann, supervisor, tool and gage service department, has worked out a solution that meets his own needs in the Schenectady plant of the General Electric Company. He will tell all about it in the next number.

The Morse Chain Company uses a lot of special equipment on chain manufacture. For its sprockets, however, conventional equipment has been adapted. During the past year or two this part of the Morse plant has been thoroughly modernized. A forthcoming article will describe the new equipment and how it is used.

These pages have frequently told of quantity manufacture in the automotive field. For a change an article soon to apear will be about the small lot production of a truck. Based on the Walter Motor Truck Company's 500-a-year output, this account will demonstrate how efficiency can be maintained even though the quantities are limited.

Included in our Reference Book Sheets have appeared a number of Time Data Sheets. All of these are based on tried standards in well known metal-working plants. These sheets will be continued for some time and will cover a wide range of shop operations. The next series will deal with the spray painting of sheet-metal parts. Others will be published in subsequent numbers.

Omega

TOUGH
and then some

OMEGA takes the heavy battering jobs in its stride. It's right in its own element when between an air hammer and some hard, defiant material. Omega was specially developed for shock-resisting parts where a combination of high ductility and hardness is required. It is unbeatable material for both hand and pneumatic chipping chisels, rivet sets, heading tools, punches and all similar tools that must stand up under drastic, repeated impacts at normal temperatures.

Omega is only one of the complete range of Bethlehem Tool Steels. Perhaps your special requirement is for a die steel with minimum shrinkage, or a high-speed steel that will stand up to heavy hogging cuts in tough materials. Bethlehem makes these and other steels, each as much a leader in its field as Omega. Reference to the Bethlehem Tool Steel Guide will aid you in the selection of the grade to handle your tasks.

BETHLEHEM STEEL COMPANY

BETHLEHEM STEEL

AMERICAN MACHINIST

ESTABLISHED 1877

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BURNHAM FINNEY, Editor

Psychic Income

So much has been said about high wages for workers that one might erroneously get the impression that a good pay check is the sum and substance of what makes a contented worker.

While an adequate pay standard is necessary in maintaining cordial relations between a company and its employees, there is another element which should not be underestimated. For want of a better title we might call it "psychic income."

"Psychic income" may sound a little forbidding and a bit highbrow. It first came to our attention when used by a friend who is wrestling with the problem of improving relations between the management and the tens of thousands of employees of a large corporation.

Just what is "psychic income?" Well, it might be defined simply as the satisfaction a worker gets from his job aside from his actual paycheck. It is partly dependent on good working conditions and partly on what recognition he secures from the men above him. It is a state of mind.

The worker's state of mind is importantly affected by his personal relationship with his company. Most of his official relations are with his immediate superior. If he and his foreman get along well, he is likely to feel that things are all right. If his foreman is hard shelled and inclined to be tough, the worker is ripe to do the bidding of outside mischief makers.

In this day of mass production, with hundreds of workers gathered under a single factory roof, it is vital that the "personal touch" between employer and employee be maintained. It was maintained back in the days of the small shop and it was an invaluable asset. Today there still are some "big bosses" who can walk through the shop and call many of the men by their first names, but there aren't enough of them.

No matter what their jobs, men want to feel that they are "on the inside" of their company's affairs. They like special recognition when they do a job exceptionally well. They appreciate serious attention being given to their ideas. In fact, many sensible and valuable ideas usually come from employees if they know that the management actually is listening and not merely pretending to listen.

Many incidents, some apparently trivial, build up or tear down employees' good will. We recall the story of the group of branch factory workers who were told one morning that at three that afternoon the president of the company would inspect their plant. They got busy during the morning and during the lunch hour and shined their machines and made everything look spic and span. Three o'clock came and the president didn't appear. At four the men were still waiting, but their high spirits had gone. A few minutes later brusque word was passed along by the foreman that the president had not found time to carry out his inspection program. The men felt let down and from then on the president's name was mud. Trivial? It all depends on one's point of view.

The company which builds up its employees' "psychic income" to the highest possible point, thus supplementing the real wages paid, is insuring itself against future trouble. It also is promoting contentment of mind among workers which will result in greater productive efficiency.

Gaging Business

THOUGH many companies in the metal-working industry have not yet experienced an increase in sales, the general trend of business is upward and the large volume of inquiries points to an active fall. Some manufacturers are inclined to be skeptical about the extent of the expected recovery because their operations have not improved so rapidly as has business sentiment. However, favorable reports come from many sources. Orders placed by federal government agencies with metal-working companies in the week ended August 11 totaled $5,486,684.51. Other huge government outlays are anticipated.

Steel production is now up above 40% and is likely to go considerably higher in the fourth quarter. Automobile makers are confident of a good fall market; they predict an output of 2,500,000 to 3,500,000 cars during the 1939 model year. The domestic demand for machine tools is better; heavy-duty equipment is being ordered by foreign buyers. Sales of electric motors and generators are expanding. The shipbuilding industry is rapidly going into a boom period. Farm implement companies are still hopeful of a fairly good upswing in sales this fall. Business Week's Index of Business Activity is at 62.0 compared with 61.6 two weeks ago.

NEW ENGLAND—Prospective government projects continue to be of dominant interest in machinery circles. A considerable amount of business will be placed in the next few months, particularly for army and navy requirements. Shipbuilding is expanding and district yards should be running at a high rate for the next year. Several metal-working plants have been closed for two to four weeks due to lack of orders.

CHICAGO—Despite disappointment that an upswing in sentiment has not been accompanied by a pronounced improvement in business, there are signs of gradual gains. Steel operations are up a few points, electric power consumption is rising, and here and there companies report good orders. Steel demand is for a wide line of diversified products, though railroads are contributing little tonnage. Farm implement and tractor companies continue seasonally slow. Machinery dealers are encouraged by an increased volume of inquiries. Railroad equipment buying is more active. Erie has ordered rails and track fastenings, Southern has bought 153 freight cars and is asking for bids on six diesel-powered two-car trains. Rock Island has leased with purchase option 16 diesel locomotives from Electro-Motive Corp. Youngstown Sheet & Tube will spend millions in adding to production facilities at its Indiana Harbor works.

PHILADELPHIA—Thanks to government purchases for various projects, machinery orders are pointing upward. The number of inquiries indicates that good machine tool bookings should materialize in the next 30 days.

CINCINNATI—New orders for machine tools have sagged. Even foreign bookings, which have bulwarked production for many months, have fallen below the totals reached earlier in the year. Indianapolis reports steady inquiries but relatively light orders for machinery.

PITTSBURGH—The Steel rate has gone up four points in the last three weeks, having continued the rise which began in June. There has been little or no stocking by mills; the gain has been in response to actual orders from a miscellaneous group of customers. The increase has come despite lack of support from automobile companies which have postponed buying until after Labor Day. American Rolling Mills, Wheeling Steel and Youngstown Sheet & Tube are among steel companies which have announced plant improvement programs. Industrial production in this district has declined slightly, according to reports of the Bureau of Business Research, Univ. of Pittsburgh.

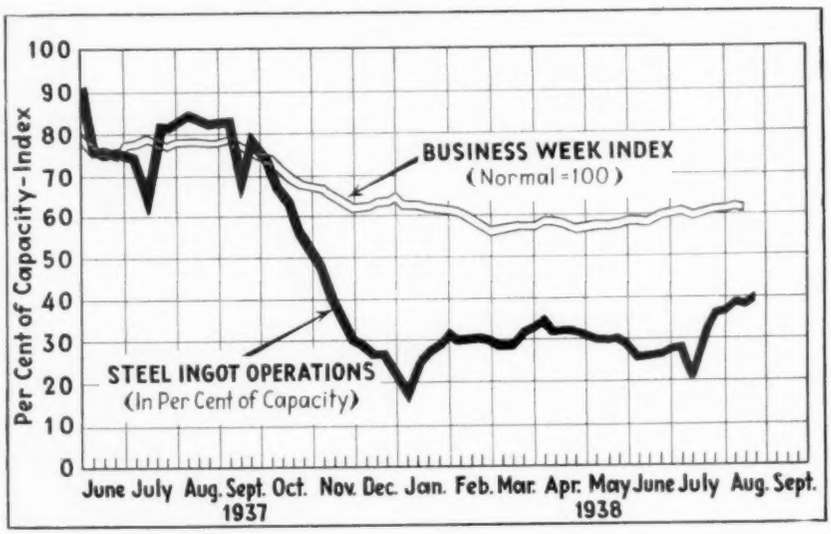
SAN FRANCISCO—Airplane manufacturers are pushing operations to meet delivery dates. Their backlogs are the largest on record. Building construction is holding up well, but machinery buying is at low ebb.

CLEVELAND—Auto parts plants are beginning to get releases from car makers which will enable them to start work at a moderate rate. Steel mills are receiving more business from miscellaneous sources.

NEW YORK—Machine tool orders have increased. Though no large lists of inquiries are out, the inflow of business is of encouraging volume. For one thing, government purchases have begun and promise to grow in importance over the next few months.

STEEL INGOT OPERATIONS VS. GENERAL BUSINESS

Steel manages to continue its recent upward progress, while the long-term trend of business still seems to be improving



New Ships in Sight

A ten-year plan for 500 ships is the heart of the Maritime Commission's program for rejuvenating the woefully obsolete U. S. merchant marine

EMORY S. LAND
Rear Admiral, U.S.N. (Retired)
Chairman, United States Maritime Commission

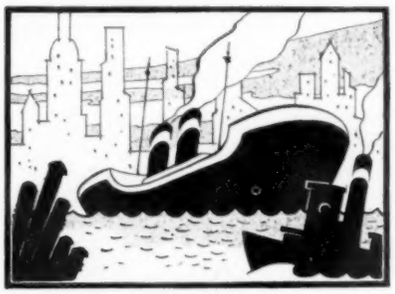
OF THE multitude of complicated problems confronting the program for the rehabilitation of the American merchant marine, the most important is that of replacements.

Our merchant marine today consists of the remnant of that great, war-built armada of 2,500 vessels which were to have been the "Bridge of Ships" to France, and with which we enthusiastically embarked after the war on an ambitious program to recapture our traditional high place among the maritime powers of the world.

Most of these vessels are now antiquated, and over 90 per cent of our trade fleet, both foreign and domestic, will be obsolete within the next four years. This deplorable situation, fraught with dangerous consequences to both our commerce and our national security, emphasizes the urgent need for replacements.

Up to this year, merchant shipbuilding in this country had been virtually at a standstill. New construction under the Jones-White Act of 1928 and its ocean mail subsidies, through which was made the first effort since the war to initiate an orderly replacement program, ceased in 1933 after 33 ships had been built as the paralizing hand of public scandal fell on the shipping industry.

Although the Jones-White Act gave us some top-flight ships of the combination passenger-and-cargo type, which were badly needed, they represented only a small fraction of our replacement requirements. What is more pertinent to the present problem is that not a single cargo ship, which after all is the back-bone of a first-class merchant marine, was built under this program, nor until this year had a vessel of this type been built for foreign commerce in an American shipyard in sixteen years!



These facts demonstrate why the replacement needs of our merchant marine today are tremendous. To replace our aging fleet would require the construction of 261 vessels a year for the next five years, and such a program at current wages of labor and cost of materials would entail the expenditure of $2,500,000,000. We have neither the funds nor the facilities for such a titanic undertaking.

The Commission's plans are to build for minimum needs. This represents a more sensible approach. A careful survey of the commercial and national defense requirements of our commerce indicates that these minimum needs call for 500 new ships in the next ten years. These ships will cost approximately $1,250,000,000. Such a program appears within our capabilities.

A substantial start has been made on this program. In the past year the Commission has awarded contracts for the construction of 33 new ships —twelve high-speed tankers desired by the Navy, nineteen cargo ships and the new express passenger liner which will replace the Leviathan in the North Atlantic service. These vessels will cost around $95,000,000. Further, steamship companies subsidized by the Commission have made commitments for a total of eighteen new vessels, most of them of the cargo type, construction of which they must begin this year under their subsidy contracts. There is in immediate prospect besides a program to build 24 ships at an approximate cost of $100,000,000 for the rehabilitation of steamship services operating from the Pacific Coast.

The Commission also is spending in the shipyards over a million dollars to modernize and recondition the three passenger liners which will be used in the new express service between New York and the east coast of South America to be established in September as parts of the government's "Good Neighbor" policy to promote our friendship with the South American Republics.

The benefits of this program are being felt and will continue to be felt with increasing force, in the shipbuilding and allied industries and the steel industry. To labor, it has been the means of saving the jobs of thousands of shipworkers as well as creating employment for thousands more. As the Commission's construction program expands, and the new Navy building program gets under way, it is obvious that present shipbuilding facilities will probably be taxed beyond capacity and that some rehabilitation and some expansion will be necessary to accommodate this tremendous volume of new building. But the situation does not justify any "gold rush" for the shipyards.

Badly as new ships are needed, the Commission has no intention of encouraging wildcat shipbuilding. Small firms and new firms will have an equal opportunity to obtain a share of the new construction, providing they satisfy the Commission that they possess the financial resources and the building facilities to perform their contracts. But they must come in with more than a *prospectus* and a *prayer*.

Precision Mills for Modern Steels

Skilled workmen and modern facilities combine to produce the precision equipment made by Mesta for the world's largest steel plants

BEN C. BROSHEER
Assistant Editor, American Machinist

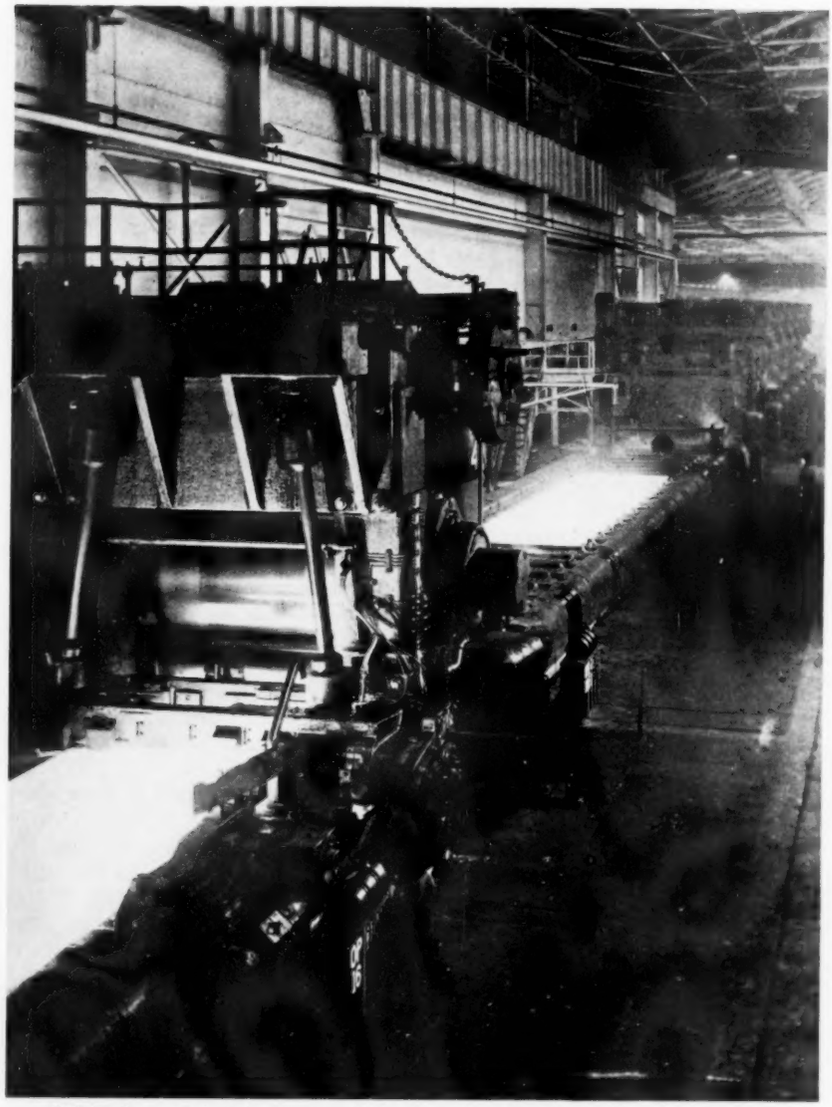
MYRON C. TAYLOR recently pointed out that the steel industry has gone through "what amounted to a revolution in the introduction of continuous rolling mills for the production of flat hot-and cold-rolled products" and that "the science of steel making has been transformed almost overnight from a rough industry into a precision industry."

The result of this transformation has been greatly beneficial to users of hot-and cold-rolled strip and sheet steel. They now are able to secure steel or more accurate gage, higher quality of finish and with working and physical characteristics not heretofore available. That in turn has enabled the fabricator to reduce production costs and to turn out a better product. It has helped him develop new uses for sheet steel and thereby widen his market.

Production of high quality flat rolled steel by the continuous process would not be possible, however, were it not for the precision rolling equipment employed in the manufacturing process. Much of this equipment has been designed and built by Mesta Machine Company.

Recent Installations

At a large steel plant near Pittsburgh, Mesta is completing installation of an 80-in. four-high continuous hot strip mill and a 42-in. four-high, five-stand tandem continuous cold mill for rolling tin plate gages. Great Lakes Steel Corporation's latest Mesta strip mill installation in its Ecorse, Michigan, works is a 96-in. four-high continuous hot strip mill, and several mills for producing auto body sheets. Two 42-in. five-stand



White hot steel slabs pass rapidly through this universal roughing stand before entering the six finishing stands of the Mesta 96-in. continuous hot-strip mill in use at Jones and Laughlin's Pittsburgh Works

tandem Mesta cold mills were installed in a prominent steel company's plant at Fairfield, Alabama. Another outstanding installation is the Jones & Laughlin mill in Pittsburgh where a complete Mesta 96-in. four-high continuous hot strip mill and cold strip four-high continuous mills are set up with a full complement of auxiliary equipment. A 58-in. hot strip mill, two 42-in. five-stand tandem cold mills, and skin pass mills, all of Mesta four-high continuous-mill design and construction, are being used by Bethlehem Steel Company at its Sparrows Point, Maryland plant. Inland Steel Company shortly will put into operation its second Mesta four-high hot strip mill. This is a 47-in. wide mill and its capacity greatly increases Inland's production of sheets and strip.

The Mesta works at West Homestead, Pa., is said to be the largest unit plant in the world devoted to production of rolls and steel mill equipment. It is set up for complete control of all necessary manufacturing processes, from melting and pouring of metals in its own foundry to final erection of gigantic mill units.

Training School

Modern production facilities in the pattern shops, foundry, forge shop, machining aisles and erection floors are operated by skilled mechanics, most of whom have been with the company for years. During normal times more than 3,500 employees work in the various Mesta departments. An apprentice school helps maintain the force of trained workmen needed for the precision work done here. Four year courses in bricklaying, core-making, electrical maintenance and repair, fitting, forging, machining, molding, pattern making, and roll turning trades are maintained for an average group of 100 carefully selected students.

A wage incentive plan, with standards determined by time study, enables employees to increase their earnings over their base rate when time allowances are bettered. The allowance for each operation is shown on a production-control card that accompanies each group of parts from the foundry and forge shop, through the machine shop, and onto the erection floor. This card shows in detail the various operations to be performed on the part.

Replacement of old equipment whenever it can be shown that a new machine will improve quality, reduce cost, or increase production sufficiently to justify the expense is an established Mesta policy. During the past year more than $1,000,000 was expended to purchase and install a large number of modern machine tools, in constructing several additions to the plant, installing new annealing furnaces and establishing a new department for producing hardened and ground forged-steel cold mill rolls. These rolls are annealed, then rough turned in massive roll lathes of Mesta design and construction, heat-treated in natural-gas fired furnaces equipped with automatic temperature control, and finally rough and finish ground in large roll grinders, also developed and built by Mesta.

This heat-treated special alloy steel backing-up roll is being turned in a Mesta-built roll lathe. Rolls measuring 60 in. in diameter and 30 ft. over-all length can be machined

Huge Castings

Foundry and pattern shops, as well as pattern storage lofts, are located at one end of the plant. Here the necessary patterns for all Mesta castings are built by skilled workmen; many of these patterns are made in sections because of the large size of the casting. In the foundry, air furnaces for iron and gas-fired open hearth furnaces for steel provide means for melting in sufficient quantity for the largest casting that can be shipped, ranging up to 350,000 pounds. Facilities for melting and casting bronzes are provided.

At one side of the machine shop, near the foundry, is located the forge shop, where a 2,000-ton steam hydraulic press is used for the production of heavy forgings. Here also are found smaller drop hammers used for production of smaller parts and all maintenance forging necessary in the plant. Separate, natural-gas fired furnaces serve these units.

There are two large bays in the machine shop where larger parts are finished. Adjoining these bays are smaller aisles in which are located machine tools and work benches for

producing smaller parts and subassemblies. Many of the larger machine tools are of Mesta design and construction. Three of the four 14-ft. planers, two of which recently were installed, used for machining massive mill housings and other parts, were built here, as were a number of large draw-cut shapers, roll lathes, roll grinders, gear hobbers, and gear and pinion planers. Each of the 14-ft. double-housing planers has a one-piece, 36-ft. cast table running on a bed plate more than 61 ft. long.

Some of the larger lathes in use will swing up to 72 in., while a huge lathe headstock is available for mounting on raising blocks where larger diameters are to be turned. Gears weighing about 60 tons have been cast and machined complete; equipment in use will produce gears measuring as much as 24 ft. in diameter with a 72 in. face. At the other extreme, shafts 55 ft. long have been machined all over.

Both large bays in the machine shop have large cast-iron floor plates, grouted in place and carefully levelled to within a few thousandths of an inch. Spaced T-slots in the top of these plates permit clamping large castings in position while heavy-duty portable mills, drills and vertical planers are placed around them for necessary machining operations. The plate in the floor of the main aisle is 60 ft. wide and 160 ft. long.

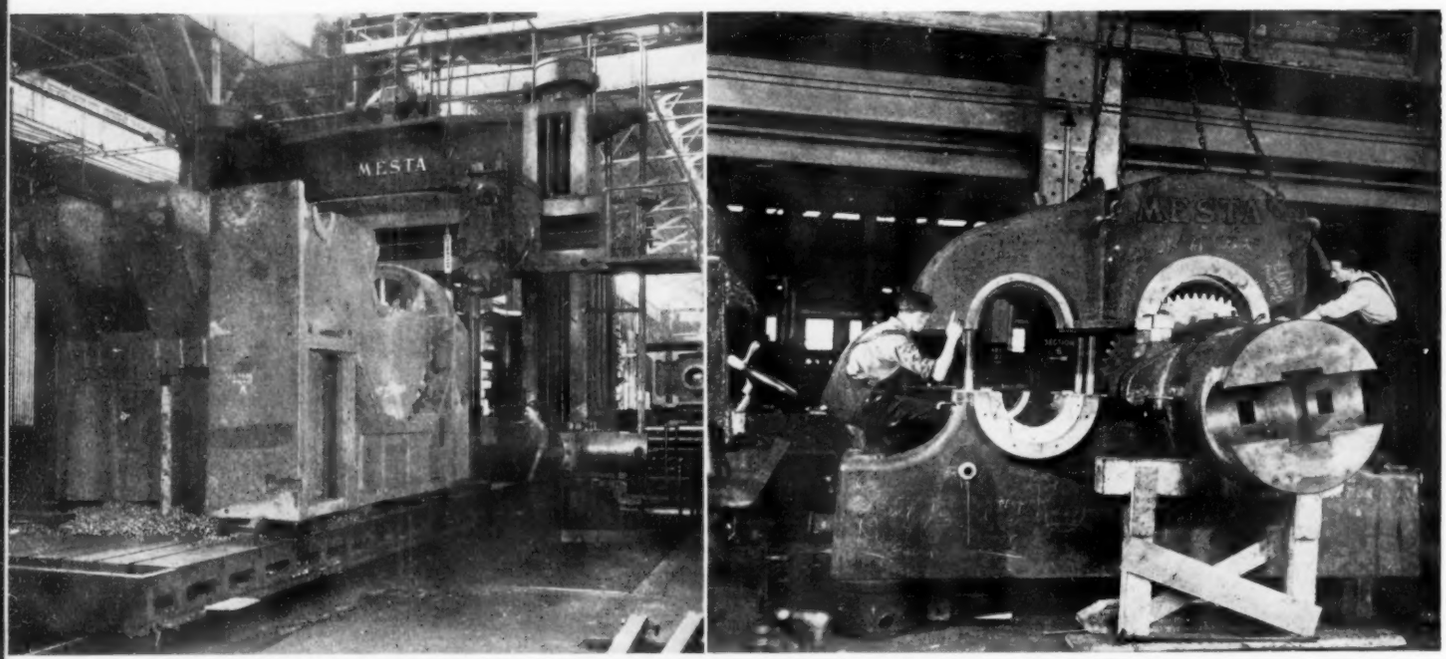
Even though many of the parts machined in this plant are of considerable size, the finished surfaces on each piece are held to close tolerances for dimensions and quality of finish. All parts and assemblies are checked carefully to insure the production of accurate parts and to prevent delays on the erection floor and in the customer's plant.

Close Tolerances

As an example of the accurate work that can be done on the equipment in regular use in the plant, it is interesting to know that the supporting columns, axes and large wheels for the 23 in. Princeton University and 61 in. Harvard University telescopes were cast and machined by Mesta. This work was done for J. W. Fecker of Pittsburgh, who designed and built the instruments.

Most of the jigs, fixtures and inspection gages used throughout the plant are made in the toolroom, which is located in one of the small machining aisles. Here are found a number of highly accurate machine tools and master gages with which all shop gages are periodically checked to maintain accuracy in machining operations. Another department fitted with highly accurate equipment produces a precision oil bearing for roll necks. This bearing requires precise machining and particular care in assembly, and is made in a department separated from the rest of the shop.

Work and back-up rolls of a wide variety of sizes, made of cast iron and steel, are machined in a roll department separate from that set up for the forged steel rolls. Here chilled and sand cast iron, steel and special alloy-steel rolls measuring up to 60 in. in diameter by 30 ft. overall length are rough and finish turned; some later are finished ground in Mesta roll grinders. High-speed steel tools ordinarily are used for turning these rolls, tungsten-carbide tipped tools being held in reserve for the chilled rolls.



Four 14-ft. planers, each having a one-piece 336 ft. long cast table, are used for machining huge castings. The one-piece casting shown weighs 257,000 lb., others weighing up to 350,000 lb. can be cast and machined in this shop. All parts must pass close inspection requirements before delivery to the erection floor. This unit is part of the drive for a huge hot strip mill

Taper Threads

Every once in a while the question of chasing taper threads crops up. Standard pipe tapers of $\frac{3}{4}$ in. to the foot are chased with the thread tool set *at right angles to the center line of the pipe.* While this makes the thread surface slightly longer on one side than the other it has been found more satisfactory in making joints.

The only taper threads chased with the tool at right angles to the taper surface is on oil well tools. The Hughes Acme Thread Tool Joint is cut with 4 threads per inch on a taper of $3\frac{3}{8}$ in. per foot and the thread is a 29 deg. Acme at right angles to the taper.

Committee for Cost Cuts

Too little attention has been given to selling low costs to labor with the result that labor has become no more efficient while machine efficiency has gone up

J. E. BULLARD

All sorts of incentives fail if labor is not taught that, in the long run, greater efficiency means more pay, that labor can buy more. Costs go down as production is speeded up; selling prices drop as production is increased. More wealth is produced as automatic machines are set to work producing it, and when there is more wealth, there is not only more to divide but more that has to be divided; usually those who have had less get a greater share of the additional wealth than do those who have more.

This factor is not easy to make labor understand. Labor looks no farther, as a rule, than the next pay envelope. For this reason, profit sharing plans, bonuses paid but once or twice a year and all deferred rewards for efficient effort have a way of failing to accomplish all that is hoped from them. There is a strong tendency on the part of labor to hold back, to obstruct, even to fight progress, not realizing that all the advance which has been made by labor during the past half century has been due to progress made in the machinery field, in scientific research, in producing more at less cost. Full cooperation on the part of labor would make this progress far greater than it has been in the past. However, the tendency of labor is to gain more and more power and to use this power to slow down, rather than to speed up progress.

Where it has been given a real trial, the following plan seems to work out satisfactorily. A committee composed of those in the wage earning class who show more than the average intelligence, who can grasp the real situation and who have real influence with the other wage earners, is organized. This committee must represent the wage earners in the truest sense. Its members must be able to see both sides of a question and to see each side with as complete fairness as is humanly possible.

Having organized the best committee possible, problems are talked over with it. For example, suppose prices have gone so high that there will have to be curtailed production and the laying off of a great many employees unless costs can be reduced so prices can be lowered. It is found the only way to accomplish this result is to lower wages. However, the announcement of a wage cut is going to start a strike.

Where there is a good committee, a meeting is held. The committee is given the facts, and the true situation is revealed to it. The question is what to do. In such a case, where there is a full and free discussion, the committee may suggest a temporary cut in wages and may indicate how this can be done without causing trouble with the wage earners. There are plenty of instances where this has actually happened.

Facing the Problem

The problem of lowering costs, however, may have a different solution. It may mean the use of more modern and more efficient machines. It may mean that each man will supervise or operate more machines and that there will be the firing of a good many of the employees. This is an even more serious situation than the first case. It is obvious that some who are now employed are not going to be continued in employment. Such a change, sprung suddenly, means trouble.

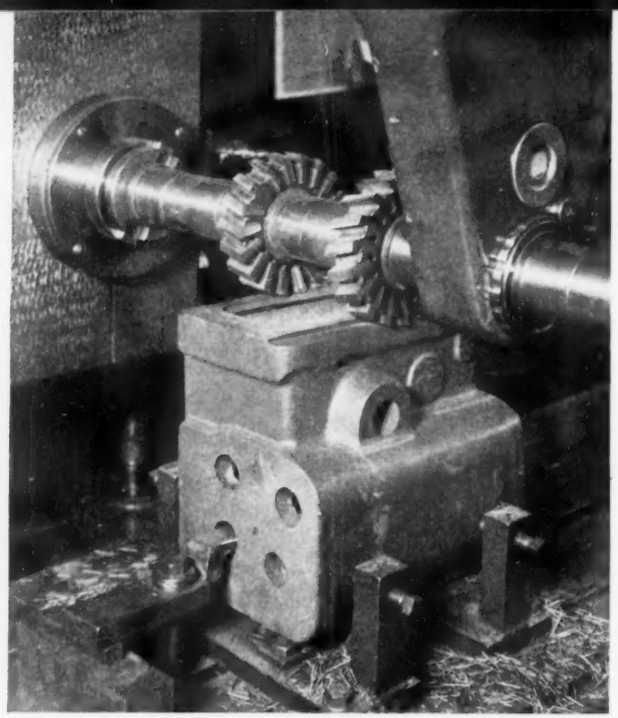
In this case the whole matter is gone into with the committee. It is explained that the step must be taken if competition is to be met. It is brought out that competition is not confined to the firms in any one industry. A more serious competition may be between one industry and other industries. If the price of cotton cloth, for example, goes too high as it did after the war, people wear less cotton. They actually turned to silk and rayon.

All this is gone into. The net result is suggestions in regard to the program to be followed in making the change. Perhaps the working week is shortened to a degree which makes it possible to retain everyone on the payroll but at a temporarily reduced wage.

The plan finally adopted is the one which the committee approves. It goes back and sells the idea to the others. As a result, production jumps to a much greater degree than would be the case if everyone did not believe that is the way to get back to the old weekly pay envelope and to make the amount in it even greater.

The employer must understand the employees and their problems. The employed must understand the employers and their problems. In very small firms this is likely to be the situation. The employees see the boss every day. He may work alongside them. They talk things over with him. They make him see their side, and he makes them see his side.

The committee idea is merely applying the same plan to larger concerns. It works exactly as well. With a committee composed of open-minded members and with employers who are open-minded, all problems which come up can be solved to the saitsfaction of all concerned. The net result is that the lowest possible costs of production are reached for the simple reason that there is real cooperation. Where such plans as this are in effect, it is often the case that the wage rates are higher than the standard for the industry. The increase in efficiency is made of real financial value to the employed as well as to the employer. In such firms it is comparatively easy to maintain an open shop.



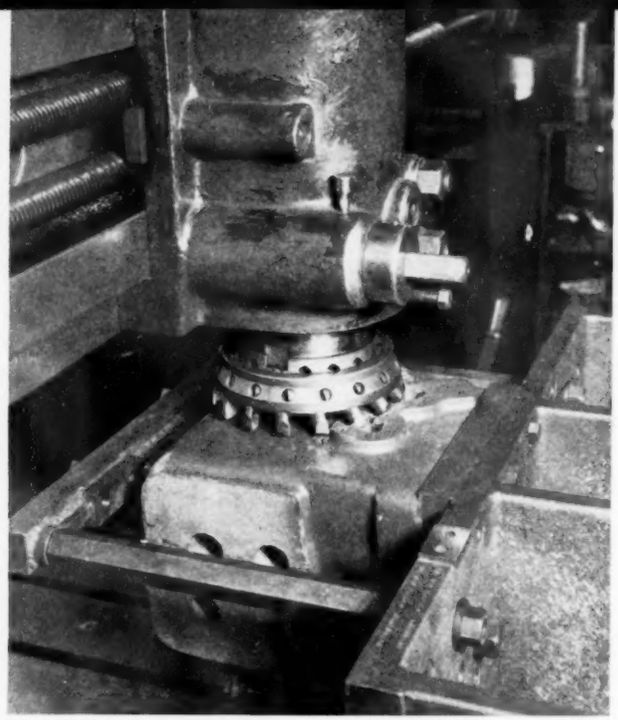
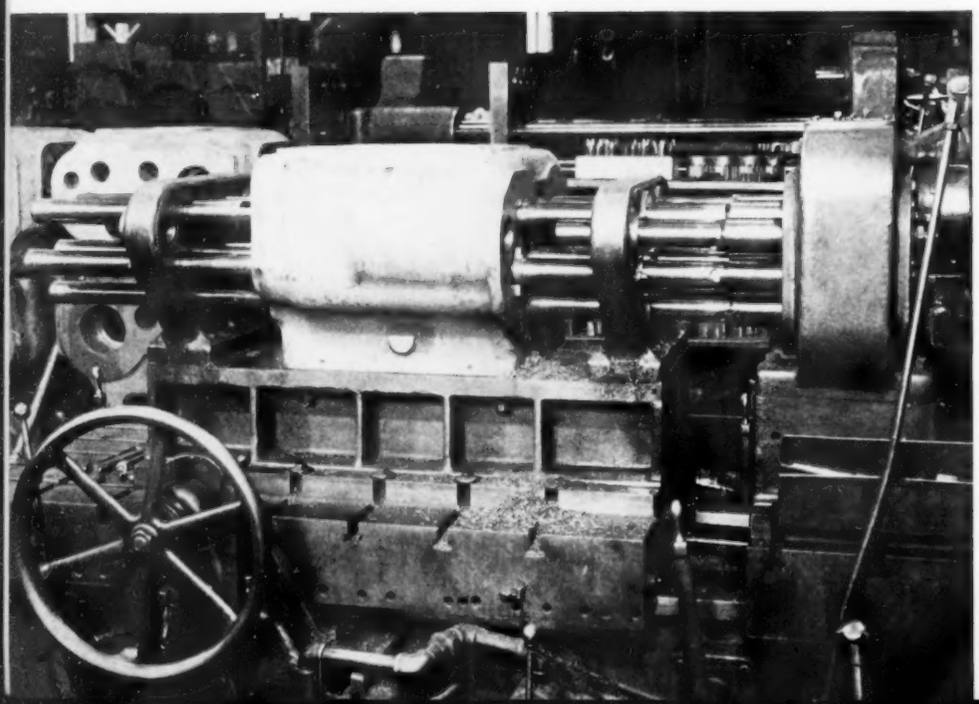


Fig. 2—Templet gages are used to locate the apron casting in a milling machine while the locating tongue is cut in the top. Fig. 3—Using the surfaces machined in the previous operation the apron is milled on front and on the bottom in a planer type machine

Unit Manufacture on Machine Tool Parts

Turret lathe parts are made in departments specially equipped to take work of this kind

JOHN E. LOVELY
Vice-President and Chief Engineer
Jones & Lamson Machine Company



EACH UNIT of the machines manufactured by the Jones & Lamson Machine Company, such as a gear, shaft or bed, is completely machined in specialized small departments. Headstocks and aprons are manufactured according to this plan, both standard and special purpose equipment being used.

The headstocks are made of fine gray cast iron. The first operations consist of cleaning, painting the outside with filler and painting the inside surfaces with oil-proof paint.

After rough and finish planing the headstock, the bottom surface of the

Fig. 1—Holes in the headstock are bored in a multiple fixture used in a lathe raised on blocks

casting and a lengthwise ledge having a face at right angles to the bottom surface are scraped to a surface plate. These are the surfaces that rest on the bed when the machine is assembled. The same surfaces are used for location in the boring machine and on the radial drill.

The boring machine shown in Fig. 1 is a special machine built by Jones & Lamson. The headstock, which has speed shifter levers to give nine different spindle speeds, is mounted on a riser block at the left end of the main casting or bed. The bed has flat ways, which are the bearing surfaces for the table or slide. Longitudinal feeds for the table are obtained through a feed selector and gear box. Duplicate controls on each side of the table to start and stop the feed are provided for the convenience of the operator.

Between the table and the headstock end of the machine, a riser block is fastened to the ways. On this block is mounted a multiple gear head, to provide a drive for each boring bar. The drive for this head is taken from the front end of the headstock spindle by means of a coupling.

The table of the machine carries the boring jig, which consists of a base casting and two upright end brackets in which are mounted the boring bar bushings. The work is fastened to the base casting of the jig and bolted down in the same manner as it will be in final assembly. All the main longitudinal holes are bored at the same time, on the boring machine. Rough and finish cuts, followed by a reamer, are taken in all holes except the spindle hole. To insure the required accuracy in the spindle hole, after the roughing cut and a preliminary finishing cut, the headstocks are removed from the boring machine and all radial drilling operations are performed. Next, the bottom bearing surfaces are checked against a surface plate. If necessary the surfaces are scraped to correct any errors and then the headstock is returned to the boring machine for the final finishing cut in the spindle hole. After inspection the headstocks are sent to the paint room.

The apron castings which are also made of fine gray cast iron, are cleaned and painted similarly, and machining then begins on a Cincinnati hydro mill. The aprons are located in the milling fixture shown in Fig. 2 with the aid of templet gages, which position the work so that a uniform amount of stock will be removed at the later operations. At this first setting the tops of the castings are milled to within $\frac{1}{32}$ in. of final size, except for a tongue of metal 5 in. wide and $\frac{1}{4}$ in. thick running lengthwise of the work. This tongue is used as a locating point for the roughing operations that follow. One edge of the tongue is in line with the edge of a $\frac{1}{2}$ in. keyway which will be planed into the castings after the roughing operations are finished.

The second and third operations, Fig 3, consist of milling the front and bottom of the castings, leaving $\frac{1}{32}$ in. of stock, and are performed on the Ingersoll planer-type milling machine. At the fourth and fifth operations the right and left ends of the aprons are milled on a Cincinnati hydro mill, leaving the same amount of stock.

Longitudinal and cross holes are jig drilled on a radial drill, leaving $\frac{1}{8}$ in. of stock on all diameters. The first finishing operation is now performed by milling the bottom of the apron on an Ingersoll. Next the aprons are sent to the planer, where the tops are finished to size and the $\frac{1}{2}$-in. keyway is planed. This keyway is used for alignment at final assembly, and also to locate the work in the finish milling, boring and drilling fixtures.

Finish milling operations are next to be done and follow the same order as the roughing operations and are done on the same machines. After the milling is completed the five screw holes in the top of the aprons are drilled and tapped on a radial drill, and the aprons go to the boring machine.

The boring machine is a 3 x 36-in. flat turret lathe adapted for boring by means of a special saddle which has a long flat table top, and a multiple gear head to drive the four boring bars. The gear head is fastened to a block set upon the lathe ways, and is driven directly from the headstock spindle by a coupling.

The boring jig, Fig. 4, consists of a vertical plate and two end brackets, mounted on a base casting. The vertical plate carries a hardened steel key to locate the apron, which is fastened to the plate by screws. The end brackets hold the boring bar bushings. The boring bars carry both roughing and finishing tools, the tools being spaced in the bars so that the roughing cuts are completed before the finishing tools start to cut. The boring bars are connected to the multiple gear head by a short steep taper and a cam-lock screw. To adjust the tools in the boring bars the operator uses a V-block micrometer.

After the boring cuts are completed, the four holes are line reamed to final size, using a piloted reamer. The boring machine operator performs this operation by hand, while the boring machine is working on the next piece.

Following the boring operation the aprons go to the radial drill, where the cross holes are jig drilled and reamed to finish size. The final drilling operations on the ends, sides, top and bottom are done next, and include counterboring, drilling and tapping the small screw holes and drilling the oil holes.

The final operations are the milling of two small slots on a Cincinnati vertical mill and the broaching of a $\frac{1}{4}$-in. keyway on a Hydro press.

The aprons are inspected on a fixture, in which test bars are inserted so that all major holes can be checked for alignment, centers and size.

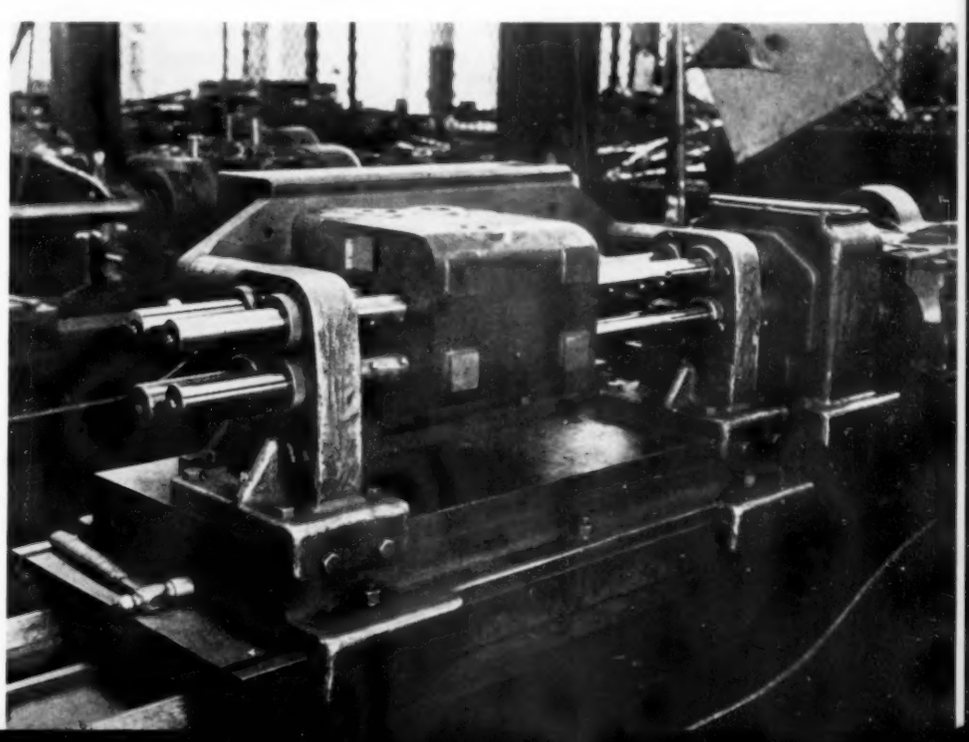


Fig. 4—An open-sided fixture is used for boring the front in a flat turret lathe adapted for this purpose

PRESS WORKING OF METALS • NUMBER 3

Press Production Aided by Feeding Devices

Manual or automatic stops and dial feeds are available in a number of designs for application to the dies or to be built into the machine

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SELECTION of the proper feeding device involves a study of the speed of operation desired, the press equipment involved, the nature of the work to be done and the accuracy required. Simple feeding devices can be built into the tools for certain classes of work, or a simple attachment may be fastened to the machine. But as the work becomes more complex or the speed of operation and accuracy become important, as in mass production of automobile parts, a high degree of engineering skill is needed to design suitable feeds. It is conceivable that the tools and feed mechanisms must be designed together in order to operate satisfactorily under such conditions. And the cost of tools and press attachments can well exceed the cost of the press itself. That is why expert engineering assistance is often required from the equipment builder.

Hand Feed and Pin Stop

This is the simplest method known for passing a strip through the stations of a blanking die by hand. For feeding the strip from right to left, a positive stop pin, Fig. 1, is vertically driven into the face of the die block. The right edge of the pin is located from the right edge of the die contour, parallel with the direction of feed, and by a distance which is equal to the length between blanking stations.

The height of the pin is about $1\frac{1}{2}$ times the stock thickness, or more. The pin is placed well below the horizontal centerline of the blanks to facilitate raising the front edge of the strip when passing the blanked hole over the top of the pin. Registering the right edge of the blanked hole against the pin exposes a new portion of the strip for cutting the next blank.

It is advisable to locate the pin from an angular right-hand slant in the die edge if possible; the same directional slant as the left side of the letter V. The reason for this is that when the cut edge in the hole registers against the side of the pin, the angular edge naturally forces the top edge of the strip against the back gage on the die.

Automatic Stop

The simplest design for this type of stop is given in Fig. 2. There are those who contend that this stop is no better or faster than a pin stop, but the usual reason behind the contention is that they do not fully understand how this particular stop should be designed. The slot in the stripper plate for the finger must be so loose, at point *A*, that the gaging end of the finger can move freely back and forth in a direction parallel with the feed of the strip. Width of the slot at this point should provide a clearance equal to the thickness of the material strip. The finger, while fairly tight at its fulcrum pin, should be able to touch both sides of the widened slot *A*.

A vertical trip finger from the punch contacts the pad and forces the feed finger up when the ram descends, but not until after the blanking punch has entered the die. In this position, the tension spring on the finger should cause it to hug the side of the slot nearest the die opening. Its successful operation depends upon the feed finger coming down on top of the strip when the ram ascends, and *not* in the blanked opening from which it was just lifted.

Commercial Stops

These automatic stops are made in complete units and may be readily attached in any type of progressive blanking dies. They operate on a variation of the principle already described, and the position of the stop being changed. The finger of these stops is revolved 90 deg. toward the left on point *A*, from the position shown in Fig. 2. The finger is thus parallel with the material strip, and the pad extends over the left end of the stripper plate.

There is no looseness in the slot that confines the finger. The "flip over movement" which causes the stop to land down on the strip, when the ram ascends, is accomplished by a vertical stop pin loosely attached to the end of the finger by a ball joint. The ball which carries the stop pin is really a separate pin that slides in a hole drilled in the end of the finger parallel with its length. A compression coil spring behind this pin acts for the same purpose as the tension spring in Fig. 2. This mechanism is held together by confinement within

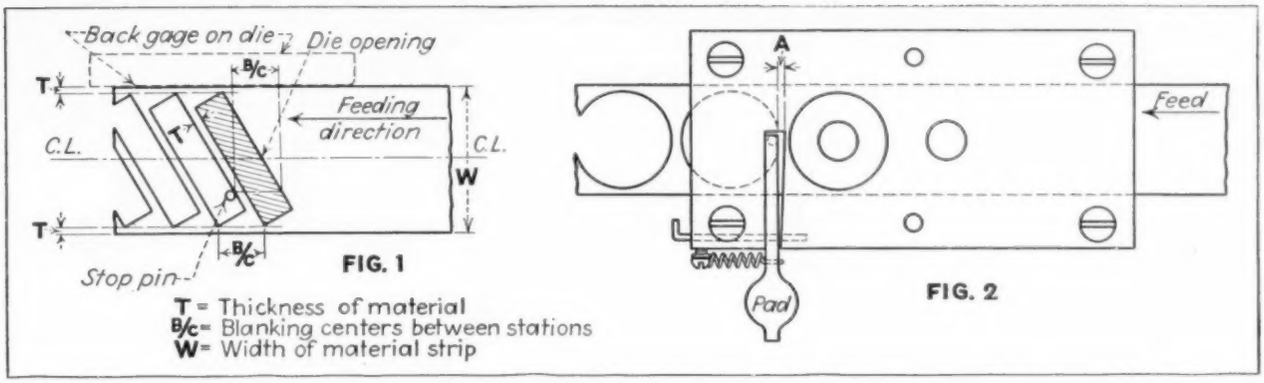

FIG. 1

FIG. 2

Fig. 1—A positive stop pin should be placed well below the centerline of the blanks in order to facilitate hand feeding. Fig 2—Automatic stops work properly only when the slot in the stripper plate gives a loose fit for the finger

a combination slot and hole through the stripper plate.

Automatic Finger Stop

This equipment is fully adjustable. It can be purchased separately and attached in the press, as shown in Fig. 3. It is designed for use on open dies that have no attached stripper plate in which to operate the conventional automatic stop. By its use, the press can be run continuously.

A finger feed is also used to operate a side swing automatic stop. In this case the finger is pinned on a horizontal shaft mounted on top of the stripper plate, in the rear of the die. Necessary looseness, required to allow the finger to pass the top of the strip before registering, is accomplished by a proper clearance fit of the finger on the shaft. The further side of the finger from the die positively stops against a pin driven in the top face of the stripper plate, and a wire spring forces it to clear over the neck in the strip before descending into the next blanked opening.

A finger motion used in connection with roll feeds consists of a cross-shaft carrying a finger that acts as a stop when down. This stop, shown in Fig. 4, is raised and lowered between feeding intervals by means of a tripping arrangement operated from the ram, in connection with a spring.

Vertical Pin Automatic Stop

Fig. 5 illustrates the idea. The right side of spring pin *A* is the stop. The pin is located to suit the blanking centers of the die. Face of pin *B* is adjusted a suitable distance ahead of the blanking punch face; it is then locked by tightening the nut shown on the hook bolt. Pin *B* is $\frac{1}{32}$ in. *less* in diameter than pin *A*, and is located so that the $\frac{1}{32}$ in. is distance *C*. When the ram descends, the face of pin *B* contacts and depresses *A*. Before the surface of *A* disappears below the under side of the strip, the blanking punch begins to cut. The ram, continuing in descent, depresses *A* below the surface of the die block.

In ascent, the strip is carried up with the blanking punch as usual. When the top surface of the strip contacts under the stripper plate channel (stripper plate omitted for clarity), the punch withdraws and the hand pressure on the strip causes the bridge to contact the right side of pin *B*. As ascent continues, pin *A* follows up but contacts the strip under the bridge between the blanked holes, while pin *B* ascends out of the stripper plate. With *B* removed, the advance of the strip exposes the blanked hole over *A* and allows it to attain instantly its normal free height. The right edge of the last blanked hole then registers firmly against the side of *A*. This action completes the cycle, and the strip now presents a new surface for the next blank.

This stop is used for blanking rather heavy material where the width of the scrap bridge is $\frac{3}{32}$ in. or more. Its fault appears when attempting to blank thin strips having narrow bridges, or when the location of *A* leaves insufficient steel between the edge of its hole and the left edge of the die opening.

Self-Contained Stop

A unit automatic stop that can be stocked in quantity for future use is illustrated in Fig. 6. Body *A* is a cold-rolled steel block counterbored for plunger *B* which is a working fit. Cap *C* closes the spring chamber. The cap is provided with a screw driver slot, and pinned through, for adjusting the torsion of the attached spring within the chamber. The coiled spring acts both in compression and torsion. In compression, it maintains dimension *D* open until the strip is pushed forward and closes it for cutting the next blank. Dimension *D* is equal to the thickness of the work material.

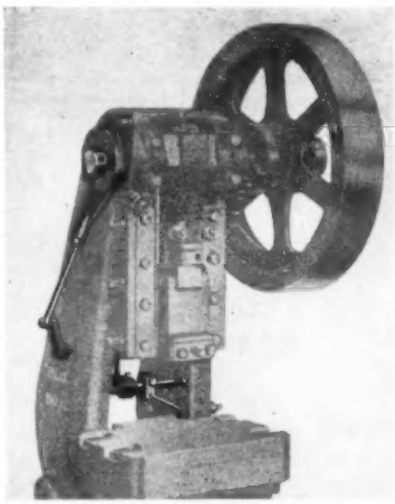

Fig. 3—Automatic finger stops are available for open dies that have no stripper plates in which to operate the conventional stop, and they permit the press to be run continuously

Fig. 4—A tripping arrangement connected to the ram operates this finger stop for straight-side frame presses

The ram, in descent, carries down the vertically adjusted trip finger *F* which is attached in the punch holder; the finger contacts *E* and rotates it away from the blanked edge where it has been engaged. This occurs after the punch has entered the die. In this position, the spring forces *B* and *E*

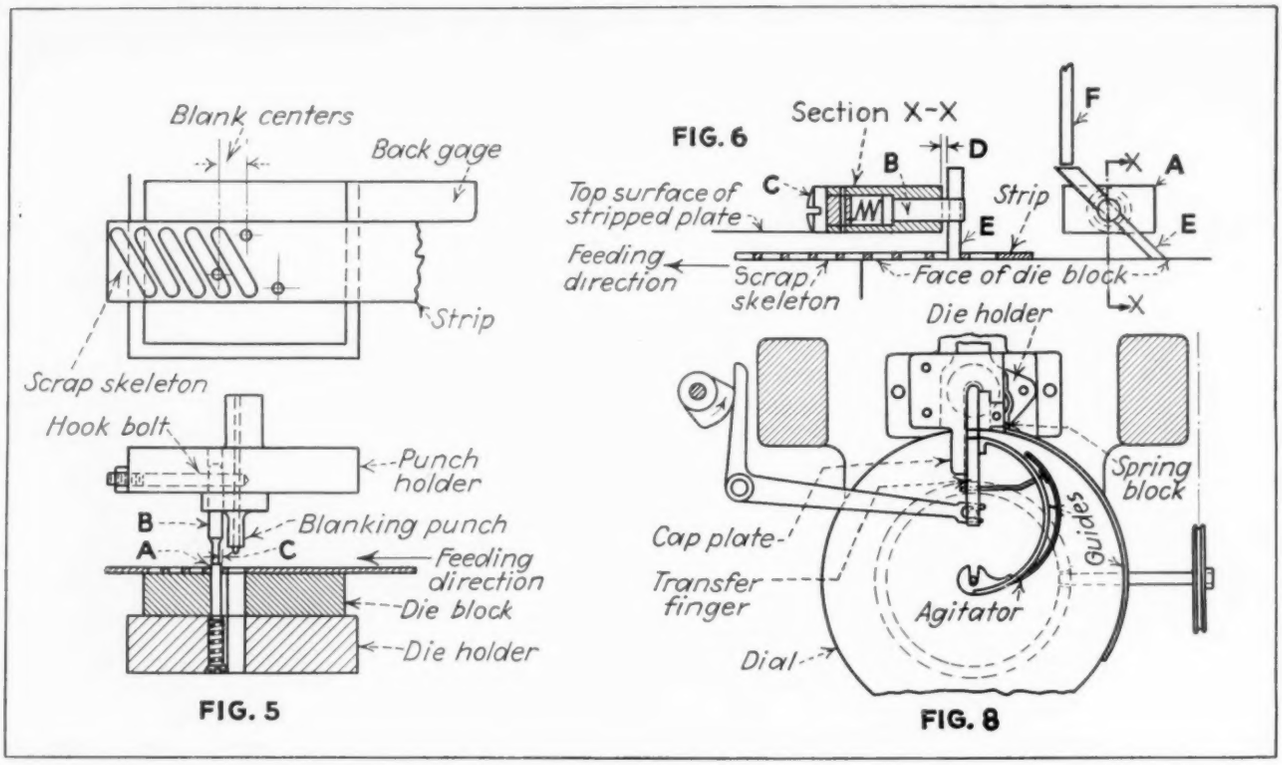

Fig. 5—Because of dimension *C*, the blanked strip is able to ride over the spring stop pin *A* when the ram ascends. Fig. 6—In this self-contained automatic stop, the stop *E* is rotated away from the gaging edge by *F* and onto the scrap bridge by the spring. Fig. 8—Friction dial feeds are applicable to redrawing shells, which are carried between guides to the rear and thence to the dies by means of transfer fingers

forward so that when the ram ascends and carries away the trip finger, the torsional action of the spring causes *B* to rotate *E* down upon the scrap bridge. The strip feed then advances the right edge of the last blanked hole firmly against the side of *E* which completes the cycle.

Hook Latch Feed

This automatic device is built into the press tool. It pulls the strip forward so accurately that no stops are necessary, and is placed on the left side of the die. A horizontal hook engages in the left edge of the blanked openings in the strip. A cam finger, vertically attached in the punch holder, descends and forces the hook to move the strip one station forward, just previous to blanking. A tension spring causes the hook to assume its normal position, ready for the next throw when the ram descends. When using this feeder, a spring friction bar, resting against the front edge of the strip, aligns the material strip against the back gage. This arrangement prevents overthrow feeding, and maintains the strip positions at the blanking centers.

Dial Feeds

The applications for this feed, by using a little ingenuity, are almost without number. They include redrawing, piercing, notching, stamping, broaching, wiring, burring, bending and many other simple operations. It can also be used for multiple operations such as riveting and assembling two or more parts. In performing operations at more than one station, it is advisable to balance them so that the punch strain will not be excessive on either side of the ram. Dial feeds can be made fully automatic by attaching a combination chute and hopper for feeding shells or other parts to a dial, as shown in Fig. 7. This arrangement is justified when the output is sufficiently large. Dial feeds are best suited to the single crank gap type presses, but are sometimes used inclined when the work is suitable for ejection behind the press.

In operation, the work pieces are placed in duplicate stations on the face edge of the dial; they are then indexed with the dial, and halted under the punch for operations. The work removal occurs at stations beyond the die, by using vertical ejector pins operated from underneath, or by a side action cam, or by using a "flip-off" finger.

It is possible to eject certain work through its nest in the dial, by the descent of a contacting punch. The dial and work are indexed beyond the die, one or two stations, and over a clearance hole through the die shoe. The punch, in descent, is then in vertical line with the work, the nest and the clearance hole; this method of work removal is simple when conditions in the tool design can be made favorable for using it.

A positive lock is necessary for holding the dial stations at punching centers. This is accomplished in several ways. One method is to attach a bullet-nosed pilot pin in the punch holder; the pilot, in descent, enters a bell-mouthed shouldered bushing in the dial, and locks it in position.

Hand Fed Dials

In using this type of dial a serious difficulty arises. The operator may fail to index the dial fully into the next station, and when the ram descends, the punch wrecks the dial, the tool itself, and perhaps the press. To avoid this, the clutch must be operated either by a mechanical control, or by a limit switch used in conjunction with the movement of the dial. This control, placed at the circumference of the dial, and in contact with a suitable cam face, prevents tripping the clutch unless the dial is correctly positioned with a station directly under the punch.

Hand-fed dials are locked in operating position by the descent of bullet-nosed pilot pins ahead of the punch, and which enter large bell-mouthed shoulder bushings positively located in the dial disk. These pilot pins will relocate the dial and work ahead of the punch descent, even though the work station is erroneously positioned $\frac{1}{4}$ in., or more, either way.

Friction Cartridge Dial

This dial is simply a plain steel disc fastened to the flat face of a bevel gear by which it is driven. The gear revolves on a vertical stud in the dial bed, the latter being attached to the press bed, and is easily removable, together with the dial.

While this equipment is largely used for redrawing and sizing cartridge shells in the munitions industries, it is also a general purpose tool. It is readily adapted for redrawing, or other secondary operations, on shells which have a flat bottom of sufficient diameter to stand upright on the face of a slowly revolving dial.

This friction dial mechanism is applicable to any single action gap-frame press. Its construction and operation is diagrammatically illustrated in Fig. 8. Here it is seen that the dial is driven by a round belt and bevel gearing. The dial is continuously revolved. Shells are placed on the dial, closed ends down, and are carried in between two guides. They pass to the rear of the dial, and are prevented from clogging by the action of the agitator shown. After leaving the guides, the shells are carried in to the dies by a transfer finger. This finger is actuated by a spring, and is positively returned by the cam shown at the left.

The dies are located in a holder attached to the die bed, which can be swung to the rear for replacements. A cap-plate on the die holder guides the work and enables the transfer finger to locate the shells directly over the dies. A spring block on the cap-plate exerts tension on the shell and thus prevents it from tipping while being transferred over the center of the dies. The dies are in pairs, and placed one above the other in the holder. They are a floating fit in a bushing provided in the die-holder. The upper die is for the first draw, while the lower is for the second draw, or sizing operation.

Duplex Friction Dials

Such equipment is of special construction for redrawing and sizing munition shells in great quantities. They are built into a special duplex press for that purpose. The press has two cranks and gates that operate in vertical slides standing side by side. Two sets of tools are used in each press, stripper plates, special double guides, and special carry-in fingers which hook around two shells, and transfer them in pairs to the dies. This type is only used where the shells are of uniform size, and when the requirements are large enough to justify the expense.

Auxiliary Dial

This is a friction driven dial, and revolves continuously. It is mounted in front of the ratchet dial and in the same plane with it. It is used in feeding shells, or other work, into the passing stations on the ratchet dial. Shells are placed on the friction dial with closed ends down. The friction dial arranges the shells in a single line and feeds them, one at each station, similarly as shown in Fig. 7. The carry-in lever is actuated by an extension of the regular pawl slide at the left of the ratchet dial.

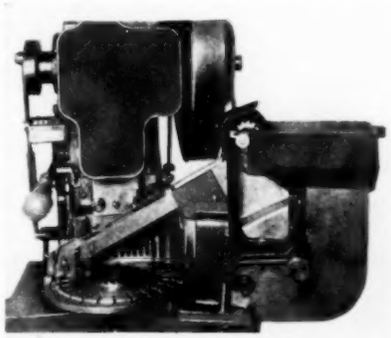

Fig. 7—Dial feds can be made fully automatic by attaching a combination chute and hopper

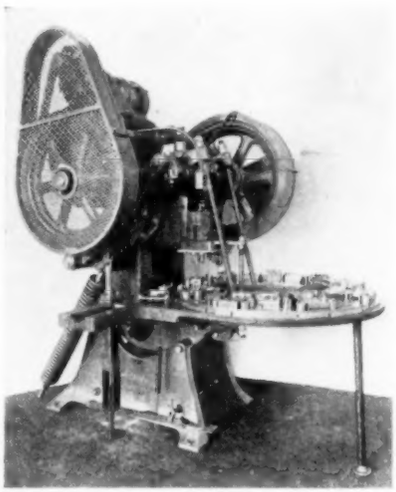

Fig. 9—In a complex set-up such as this, the parts of a toy or novelty may be completely or partially made by press work and assembled. Two operators are ordinarily required

Two-Operator Dials

When two or more parts are fed to a dial for press assembling, a large dial is often employed, about 20 to 28 in. in diameter. The extra size provides places for two operators in front of the dial. An example is one in which rubber eraser tips are pushed into their cap shells in the manufacture of mechanical pencils. The first operator, at the left of the press, places the metal caps closed ends down, in the passing dial stations, while the second operator, at the right, places the eraser tip in a guide over the open ends of the caps. In passing under the ram, the punches in descent, assemble three eraser caps per press stroke.

Acknowledgements are made to the V & O Press Company and the Waterbury Farrel Foundry & Machine Company for some of the illustrations published herein.

Mr. Hinman will continue the subject of press attachments in an early number.

Gear Welding

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In 1926 a fabricator of steel forming machinery, in the middle west, started making his own gear blanks by welding because he was not able to buy the kind of gears he wanted at anywhere near the cost of making them in his own plant. In other words, he made a new kind of gear. They must have been good gears because several other manufacturers purchased them for installation in their own machinery.

Welded gears are not copied in shape or dimensions from cast gears. They are redesigned. Most of them are gears of comparatively large size, and a good proportion of them are made for special purposes and consequently to special dimensions. There is obviously an economy here in the saving of pattern costs, which is welcome. But stopping here means restricting the application of welding to special orders and to the larger sizes; whereas, if welded construction is ever going to mean very much to the economics of the gear industry, it must find a much broader application in the smaller sizes where the volume is much larger.

From a paper presented before the 22nd annual meeting of the American Gear Manufacturers' Association.

Chrysler's Test for Springs

A new machine for checking suspension springs insures closer tolerances in the product

INCREASING softness of automobile suspension springs demand a higher degree of accuracy in measuring spring rates and loads. Errors of five or ten pounds in either characteristic may have a marked effect on the riding quality or appearance of a car having suspension rates at or below 100 lb. per in. Yet many spring testing machines have limits of error in excess of ten pounds.

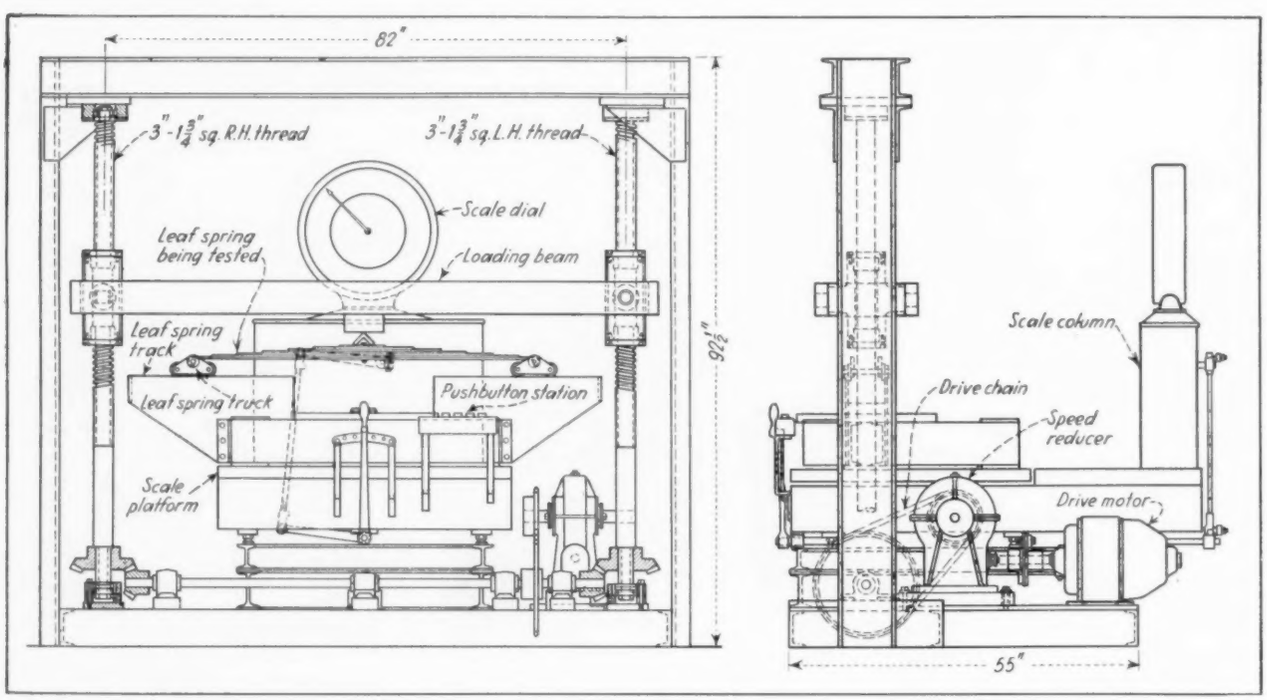
In designing a spring tester for laboratory use, the Suspension Department of the Chrysler Engineering Laboratories determined that the machine should have the following characteristics: (1) accuracy of load readings should be unquestionable; (2) load indicating device should be graduated in increments not greater than one pound; (3) machine should be as nearly automatic as possible in order to save time and eliminate human errors; and (4) it should deflect the springs to certain specified loaded heights without the need for visual observations and adjustments of the spring height by the operator before reading the load.

A platform scale of the springless type was selected as being dependable for measuring the load, since its accuracy easily can be verified with dead weights. A motor driven mechanical system was chosen for applying the load to the spring in order to be able to hold the spring in the desired position over a period of time. Framework of the machine is built of standard structural steel shapes which, together with the driving mechanism, are covered with sheet metal panels for appearance and safety.

The superstructure built on the scale platform transfers the load to the corners of the platform, directly over the supporting knife edges. Tracks are provided for the leaf spring trucks in which a variety of pins and spacers automatically center the ends of leaf springs of any specified width and eye diameter. Coil springs and the control switch pedestal are mounted on a centrally located heavy steel plate.

The driving and loading mechanism consists of two screws at opposite ends of the leaf spring track. These screws carry and drive the loading beams and head through bronze nuts set in iron castings, thus leaving an unobstructed view of the scale dial through the center of the machine. Thrust load is taken by ball bearings at the lower end of each screw while a second set of ball bearings guide the upper ends of the screws.

The screws are driven at 60 r.p.m. through bevel gears by a countershaft which, in turn, is driven at 120 r.p.m by a 7½ hp. d.c. motor through a speed reducer and chain drive. Motor-to-screw speed reduction is 30:1 and



Two screws, located at opposite ends of this compression spring tester, carry and drive the loading head through bronze nuts set in iron castings. A superstructure built on the scale platform transfers the load to the corners directly over the supporting knife edges

the normal linear speed of the loading head is about 3 ft. per min.

A taring device is operated by a conveniently located handwheel at the front of the machine. It has a capacity of 50 lb., which is more than the variation between the weights of the lightest and heaviest Chrysler passenger car springs. Thus the scale dial can be set to zero after any spring is placed on the platform and before the test is begun.

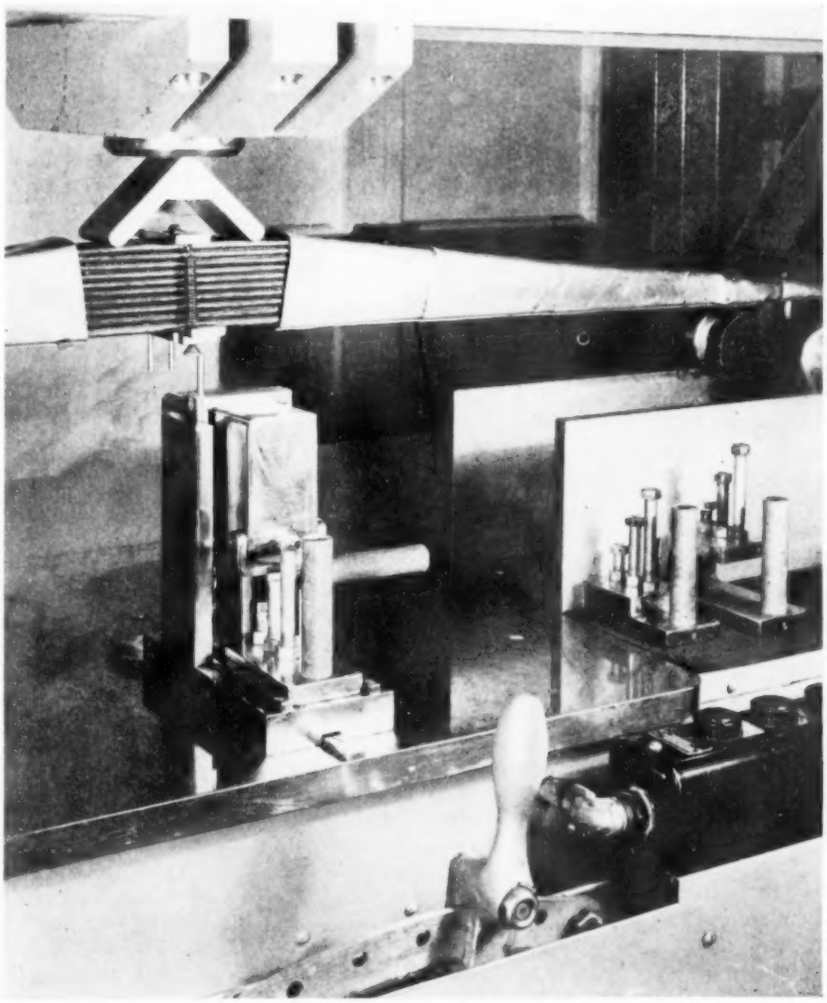
The scale dial is graduated from 0 to 1,000 lb. in 1 lb. divisions and can be read to at least one-half pound. Additional capacity is available in 500 to 1,000 lb. increments up to a total of 4,000 lb. The amount added is registered at the bottom of the dial and is controlled by a handle at the front of the machine. The tare beams can be adjusted to provide 1,250 lb. more capacity, thus making 5,250 lb. the maximum load which can be registered.

A so-called "vacuum contact tube" switch was found to possess suitable characteristics for interrupting the current for the electric driving motor and thus stopping the load-applying mechanism when the spring is compressed to the exact specified height. This is a simple single pole, double throw switch in which the contacts are sealed within an evacuated can and are actuated by a force of not more than 70 grams, which will not affect the dial reading. The extreme end of the operating arm moves only 0.070 in. from one contact position to the other so that the switch can be expected to function repeatedly with a variation in operating arm position of not more than ± 0.003 in. There are two of these switches, one to slow down the drive motor to about $\frac{1}{10}$ of its normal speed and the second to stop and brake the motor when the desired spring height has been reached. These switches are mounted in a case which is supported on a pedestal so that it can be fixed easily at various heights above the scale platform to correspond with the specified spring heights. The switch push rod extending upward from the case engages a clamp placed around the leaf spring at the center bolt. In the case of a coil spring, the switch push rod engages the loading head directly.

A five-station pushbutton control station is provided at the front of the machine. One button is a "forward" control which causes the loading head to move downward, engaging and compressing the spring until the automatic switch assembly is actuated. The second pushbutton is a "reverse" control which causes the loading head to rise to the upper limit of its travel, where it is brought to rest by a limit switch. A "stop" button is provided to stop either upward or downward travel of the head at any point. The two remaining buttons are "jog forward" and "jog reverse" which cause the machine to creep at $\frac{1}{10}$ normal speed as long as the buttons are depressed. Thus a means is available for bringing springs to heights other than those provided for by the various positions at which the automatic switch may be set. The jog control is sufficiently delicate to make unnecessary any provision for operating the machine manually.

Two other limit switches are provided. One of these stops the machine as soon as the dial pointer goes off scale. This prevents damage to the scale mechanism and serves also as an automatic stop when bulldozing coil springs with a given load. The other limit switch makes the machine totally inoperative whenever the dial pointed is located at zero. This is an important safety measure to prevent accidental overloading of any part of the machine.

Results obtained with the machine have been very satisfactory, particularly in the operation of the automatic stopping mechanism. One of the specifications set up for the machine required that when stopped on repeated tests by the automatic switch, the position of the loading head and hence the spring height should not vary more than ± 0.007 in. Repeated load readings taken on the same spring have remained well within these limits. Load readings on a typical independent suspension coil spring of about 300 lb. per in. rate do not vary among themselves by more than one pound. This means that the spring height is within ±0.002 in. of the specified height when the load is read, which certainly is satisfactory considering the magnitude of the loads involved, the mass and size of the moving parts and the fact that the operator does nothing but push a button.



A switch push rod extending through the top of the limit switch case engages a clamp on the spring when it has been compressed to the specified height. Stepped supports hold the switch case at varying heights

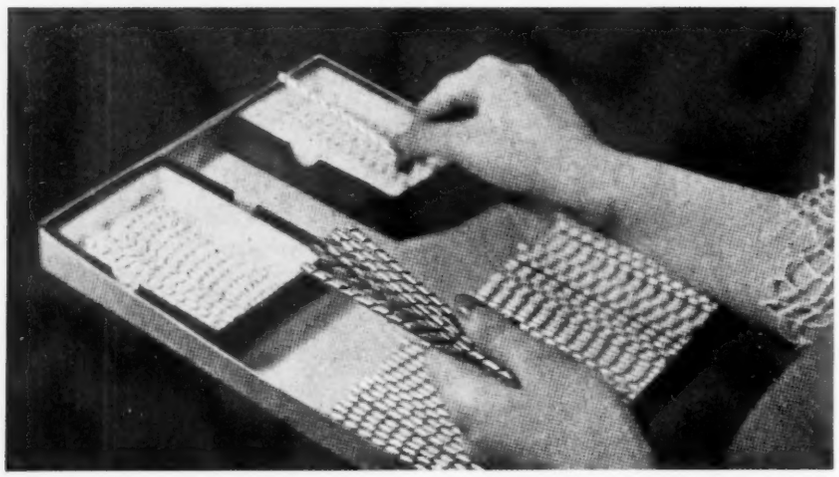


Fig. 1—To check perception, applicants are asked to sort standard and off-standard twisted rods into two compartments

Inspection for Inspectors

Does a good inspector have to be born that way? Perhaps not, but simple tests show a wide variation in ability and help to pick out persons who are qualified to pass on a company's product

CHARLES A. DRAKE
Consulting Industrial Psychologist

TWO STRIKING facts have emerged from our recent research aimed at improvement in the inspection of certain metal products. One of these is the existence of an inherent perceptual ability which distinguishes high-grade inspectors. The other is the marked increases in production attained by training as inspectors those operators who have this high inherent ability.

In developing test devices to measure this basic inspection ability one of the first and most surprising results was the discovery of the unexpectedly wide range of this ability, both in the working inspectors and in the unselected applicants for jobs. Long service as inspectors did not materially increase ability as measured. In fact, both the tests for basic inspection ability and the careful analysis of samples of the actual work pointed definitely to the conclusion that not more than 15 per cent of the inspectors on such work were really qualified and competent to do it by reasonable standards. This is a strong statement, but the facts warrant it.

Let us examine the results of a test of inspection ability shown in Table I. (Test shown in Fig. 1.) This was a work-sample performance test involving the separation of 50 defective parts from a lot totalling 100. Each applicant or employee was given a demonstration, with instructions on what was to be done and some practice on the test to demonstrate that the instructions were undersood. Then the test was timed and scored for errors. What are the results?

Four applicants were able to do the test in an average time of three minutes, and 21 did it in four minutes. But the average applicant required more than six minutes to complete the test and some required more than twice that amount of time.

Did the employed operators do better? None of them did as well as the four best applicants and one was as poor as the poorest applicant. On the average they were much like the unselected applicants. Apparently, selection by interview and the automatic elimination by experience had not been effective in obtaining superior ability.

This test was also scored for errors. How did the experienced operators compare with the applicants? One would expect the former to be more discriminating on parts similar to the ones they were handling daily, since

TABLE I
Twisted Rod Inspection Test

Time in Min.	Applicants	Operators
2.50– 3.49...	4	
3.50– 4.49...	21	2
4.50– 5.49...	48	7
5.50– 6.49...	83	11
6.50– 7.49...	63	9
7.50– 8.49...	28	4
8.50– 9.49...	17	2
9.50–10.49...	10	1
10.50–11.49...	5	2
11.50–12.49...	1	
12.50–13.49...	2	1
13.50–14.49...	1	
14.50–15.49...	1	1
Total.....	284	40

the least defective parts in the test were too much off-standard to permit assembly in the product. Table II indicates that, if anything, the experienced operators were in general not as good as the applicants who were inexperienced. A retest of 46 of the operators and employed applicants after three months, given in the last column of the table, shows little improvement in the error scores. An examination of the improvement in the time scores of these 46 (not tabulated here) shows an average gain of less than one minute, due chiefly to the reductions among those whose first test was excessively long.

The foregoing results indicate that the test is measuring something innate

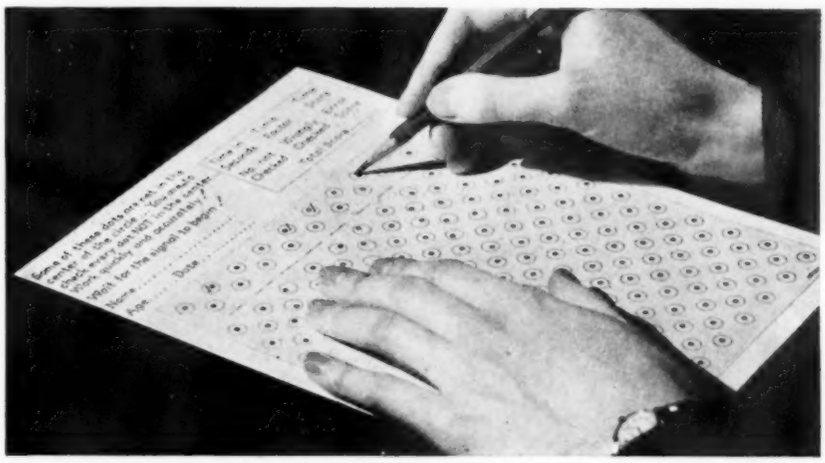


Fig. 2—In this pencil-and-paper test the applicant checks off the circles in which the dots are off-center

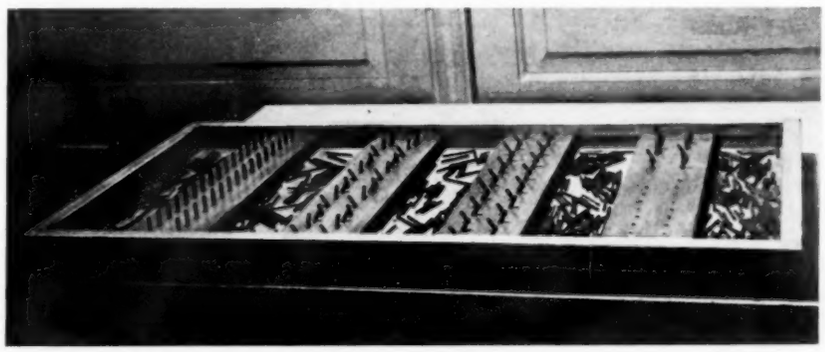


Fig. 3—Manual speed is shown by the ability to insert pins at various angles into a series of boards

TABLE II
Rod Inspection—Error Scores

Errors	Applicants	Operators	Retest—Both
0.....	17	2	8
1.....	29	8	10
2.....	19	3	5
3.....	17	4	5
4.....	14	3	1
5.....	4	2	2
6.....	7	1	3
7.....	4	2	2
8.....	5	0	3
9.....	7	1	1
10 and more.	12	14	6
Totals..	135	40	46

—something not materially affected by training and experience. Of course, defects of vision will influence the results of the tests. All visual perception tests, and especially the pencil-and-paper tests described later, should be given after vision has been ascertained to be normal or to be properly corrected with glasses. A good test given under standard conditions should give almost the same results each time it is repeated, with some small gain due to familiarity and practice. A large gain each time usually indicates that the test is not a reliable measuring instrument or that it is measuring something acquired by experience. Tests for innate abilities should not show marked gains of this sort.

Since the results of this test and of several other similar tests agree very well with the results of an analysis of samples of inspection work on the job, the implication is clear; select inspectors by suitable tests. It should be noted that this particular test was made from a sample of parts actually used in production, familiar to all of the employed operators but new to the applicants. Such a test is to be preferred to the pencil-and-paper variety of test for the final selection of inspectors.

Pencil-and-paper tests, however, have certain advantages and suitable fields of application. In measuring the ability to see, or perceive, relationships the printed test permits better arrangement in order of difficulty from very easy to very hard—a most desirable feature. Moreover, the printed test is fresh and clean each time it is given and not subject to change through the wear and tear of use. Usually a printed test will repuire less time to give and score than a performance test requiring the handling of parts, thus making it a more convenient instrument for the preliminary elimination of applicants lacking the basic abilities required for efficient inspectors.

TABLE III
Pin Board Test

Scores, Time in Seconds	Applicants	Operators	Operators at Ranked by Foreman
120–129	37	1	(31)
130–139	81	2	(2)(4)
140–149	79	6	(6)(10)(12)(13)(26)(29)
150–159	51	9	(1)(3)(5)(11)(15)(25)(30)(32)(40)
160–169	54	8	(7)(8)(9)(14)(17)(19)(23)(24)
170–179	39	4	(21)(22)(28)(33)
180–189	17	2	(18)(20)
190–199	9	4	(16)(27)(34)(35)
200–209	1	1	(36)
210–219	3		
220–229	1		
230–239			
240–249	1	2	(37)(38)
250 up		1	(39)
Totals	373	40	

From a careful analysis of our results in testing for inspection ability we have been led to design several new tests of the printed variety, samples of the patterns being shown in Fig. 2. These tests increase in difficulty from the first line through the last line, and in order of complexity of elements from Form A through the other forms. These are designed to be given to all new applicants. Persons standing high on these tests are inferred to have the basic inspection ability for visual inspection jobs and should be given several performance tests embodying the work elements of the job itself. It is also desirable to give at least one test of general manual dexterity, since successful inspection is usually related to

speed in handling the parts inspected.

On some jobs accuracy is more important, relatively, than speed, so that common sense must be used in applying tests and interpreting their results. After all, tests and statistical interpretations of test results only give us the basic data for selection. They do not automatically select employees of any classification. Sound judgment is to be used in handling the facts revealed by the tests.

Nor is the interview supplanted by the tests, although it may be materially shortened, especially in such matters as previous experience and alleged earnings. There are applicants who will make high scores on the tests but who will not be desired as employees because of defects of personality, disease, or various other temporary or permanent handicaps. Both the interview and the medical examination must be retained in the employment procedure.

Group Morale Improved

One of the curious facts we have noted in the recent use of employment tests is that the quality of the applicants has steadily increased, as shown by test scores and the proportion of the applicants offered employment. We attribute this to the spread of rumors about the testing procedures and the well-known tendency of the poorly-endowed to evade tests of any sort, in school and elsewhere. We also noted a marked self-assurance and generally heightened morale among the group selected by tests. Of course, the rapid rise of this group in earnings to the average, and often above the average, of the older employees has played a prominent part in bringing this about.

Rejection for inspection jobs does not imply rejection for a multitude of the other jobs in a factory. In fact, even failure on all the tests should not disqualify an applicant for employment on many of the jobs for which no special abilities are required—jobs existing in every plant. The chief purposes of the tests are to identify the persons having the desired special abilities and to guard against the placement of persons on jobs for which they do not have the special abilities required.

An interesting example of the success of a test in identifying unsatisfactory employees is shown in Table III. On this test of operators the point of acceptability was set at 169 sec., all scoring 170 sec. or over, being rejected for these jobs. The numbers under the heading "Operators as Ranked by Foremen" are the ranks in the group of 40 (No. 1 being highest and best, 40 lowest and poorest) as given by their foremen —ranks that were afterwards found to be based upon their weeky earnings.

Operators numbered 21 to 40 were in the lower half of the foreman's list, and he said that he would be glad to drop or transfer the last nine—Nos. 31 to 40. Of the last 20, six of the poorest seven—Nos. 34 to 39—were verified in that order by the test results. All but two of those below the point of acceptability on the test were also in the lower half of the foreman's list. No. 40 was a disciplinary case in the shop, of good ability but low earnings. No. 31, highest on the test, was emotionally unstable, irregular in employment, and low in earnings. These results were on the general manual dexterity test shown in Fig. 3.

It is evident, from the foregoing results, that there are wide individual differences in the abilities related to production on the job. While this fact is important in selection where the employee learns on the job, it is equally important—or perhaps even more important—where the applicant is selected to go through a course of formal training prior to his induction on the job.

Probably in the field of inspection these innate abilities are most directly related to the quality of the product and so to the prospect of profits for the company. No field of industrial personnel testing shows results more quickly nor more convincingly than this. In comparison with the potentialities for increased quantity and higher and more uniform quality in the product the cost of the procedure is negligible.

Without some initial scientific selection by tests of the applicants possessing the required inherent abilities, training is an expensive and wasteful process. At best such training without testing will be trial and error —try and reject many, train and retain a few. Plenty of qualified applicants come to the factory gate, but they must be identified for their special abilities and put on the jobs where they will be of greatest service to the company and will earn the most for themselves.

Sound Testing

R. S. DRUMMOND, *President*
Nation Broach and Machine Company

Often the sound which is pleasant or not noticeable to one individual is distressing to others. These factors, in the study of sound, cause confusion. The rear axle of my car is normally quiet, but when the front end of the car is outside of the garage and the rear end is jacked up inside the garage, the groaning of the axle is noticeable.

The sounds of gears which are to be studied should be entirely separated from bearing sound and all surrounding rattles and noises. This leads us to operate the gears for sound test with the quietest possible drive, the gears themselves mounted in a sound box which will surround the radiated noises from the gears, to the human ear.

A basic requirement is the use of the human ear as no other instrument has been developed which will readily measure quality of sound. Sound must be pleasing to the ear, and the ear is the only instrument which can measure this quality.

Some years ago, a sound testing device in one of the larger universities was expected to prove of great value in diagnosing gear trouble. A rear axle was rotated with the gears in mesh, and the noise from the gears was picked up by radio and transferred to a silent room where it could be heard.

To measure the noise as to quality, a pipe organ was used and the stops on the organ were set to match the sounds of the gears. Upon investigation, it was found the tones in the organ could be broken down into a series of elements. This method proved nothing except the ingenuity of the engineers who devised it, as they could not give any calibration on instruments and mark them "good" or "bad" in respect to the human ear.

Later, another instrument was suggested for measuring the vibrations of gears by means of a meter and with the aid of an acoustic engineer, a series of tests was made on different gear sets, both in groups and in pairs. The test proved there was at present no calibration of quality of sound in relation to the number of vibrations excepting certain extreme sounds, which due to their high pitch, were naturally objectionable. For these sounds no instrument was necessary.

From a paper presented before the 22nd annual meeting of the American Gear Manufacturers' Association.

DAD SAYS

I Ain't Never Wanted To Be a Foreman

I'VE BEEN workin' in this same plant now almost twenty years. Most of the time I've been in the maintenance gang, just like I am now. I've never been a foreman and the last few years I haven't even wanted to be one. Some of my friends can't figure me out, but the trouble with them is they don't understand either me or the shop.

Now, some men just like to get to where then can be hard-boiled and boss others around, but I'm not like that. I have heaps of friends in the shop, most of them fellows just like me, and they like to talk things over with me. I help out some of them by loanin' them money. I've made a pile of friends and ain't lost much by doing it. Now you see, if I was a foreman the company wouldn't want me to loan the men money and, anyway, if I was a foreman they just wouldn't come to me the way they do. *So* that's one reason I rather be where I am.

Another reason is you don't get enough extra out of it to make it worth anything. My foreman only gets a little more than I do and he's always catching Hell about something. And then he ain't half as sure of keeping his job as I am. They can fire him or cut him back any time without explaining to anyone, but with me they never know what the union might do about my case—even though I don't belong to the union now. If there's a lot of overtime they may give him a salary, and if things get slow they put him back on an hourly rate. If he lasts ten years he may get to be a General Foreman or even a Superintendent but I wouldn't go through ten years of grief for that chance. So that's another reason why I'm not interested in being a foreman.

Of course I know I'm not much of a success the way they rate people today, but I've had the fun of raisin' three fine kids. I've spent a lot of time with them and I think I've helped 'em to understand life. And you know I kinda feel sorry for a man who is so successful he couldn't find time or was too worried about his job to enjoy his kids.

Built-Up Form Tools

Made as separate units, then clamped solidly together to form the desired contour, elements for a multiple-part tool usually require only simple grinding operations

FRED W. LUCHT
Design Engineer, Carboloy Company

BUILT-UP form tools, consisting of two or more units individually produced and assembled into one complete unit, frequently offer a solution to costly manufacturing and maintenance problems otherwise involved when producing and applying the usual solid type of tipped form tool. The multiple-design Carboloy-tipped form tool shown in Fig. 1 is a good example. This tool consists of seven units assembled to form the desired shape. To produce this tool as an integral unit would require a considerable number of operations that are eliminated by the use of a multiple-design.

For the solid tool, the hard Carboloy blank probably would be supplied in a three-stepped, rough-formed shape. After brazing to the shank, this rough shape then must be ground down to the approximate contour of the shank. Obviously, a subtsantial amount of grinding on the tip would be required to remove the excess stock. Following the rough shaping of the tip, the actual work on the grinding and lapping of the contour is started. To produce the numerous sharp corners desired it is apparent that the grinding required prior to the actual lapping operation necessitates frequent dressing of the grinding wheel. This takes its toll in rapid wheel wear, dresser cost, wear on machine caused by excessive dust, and time required to meet the exacting specifications.

The operation also necessitates frequent checking with depth micrometers, height gages or on a projectograph. In some cases the occasional running of sample parts may be employed to indicate the exact progress of the work. There also is ever present on work of this kind the hazard of spoilage at some important part of the contour, necessitating a complete re-make.

Multiple-design greatly simplifies this problem. This tool can be produced with exactly the same contour as the solid type, but it now consists of seven individual tools clamped together to form the desired contour. Each unit is made as a separate tool and, aside from the lapping required, is as easy to produce as any ordinary straight-shank, single-point, turning, facing, boring or grooving tool. All complicated grinding operations to obtain sharp corners and exact contours, are eliminated, with a consequent saving in wheel wear, grinding time, and dressing cost.

Of value, too, is the fact that accidental spoilage usually will scrap only one unit rather than the entire form, as is the case with the solid form tool. Grinding consists simply of surface grinding the tools to the proper thickness or width, lapping the contacting sides, and hand grinding and lapping to establish the correct rakes and angles. When completed, the seven units are clamped together and the correct contour established by adjust-

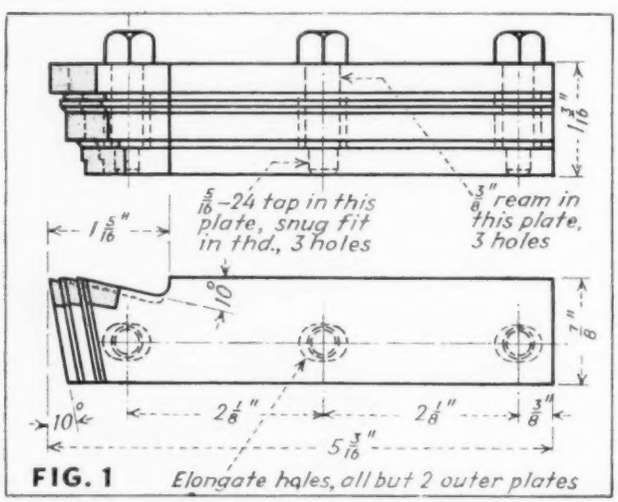


FIG. 1

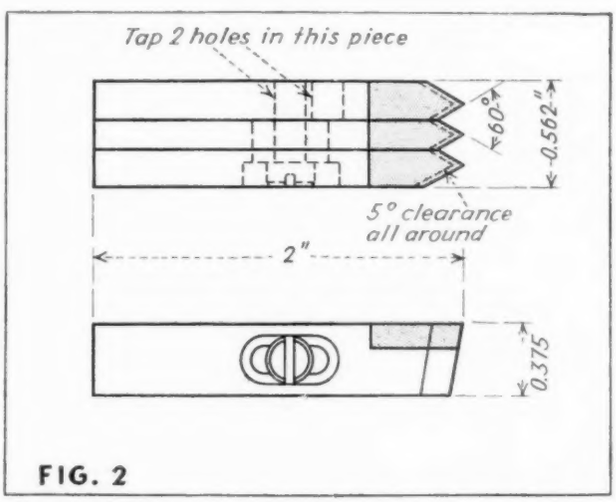
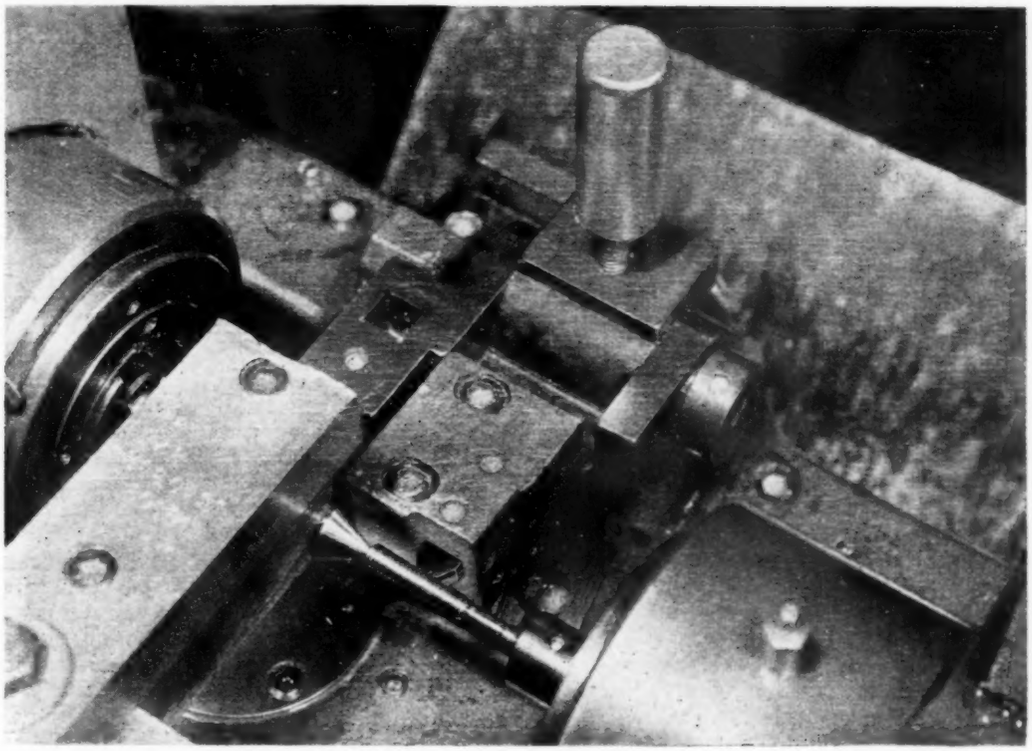


FIG. 2

Fig. 1—Seven simple tipped forms are assembled, after grinding and lapping to finished size, to make this multiple-design contour-turning tool. The sharp corners required would be difficult to obtain were the entire contour ground from a single block. Fig. 2—The three easily-ground units that make up this sharp-angled tool are readily adjusted



Multiple-design of form tools is of particular advantage where one or more sharp corners are required, holding grinding time to a minimum

ment. Thus, only one check of the contour is necessary during the manufacturing procedure. Rapid adjustment to exact contour is made possible by means of the elongated slots shown.

The built-up type of form tool also offers substantial savings in maintenance costs. If one section should require more frequent resharpening, you grind that section only. If one section is accidentally broken by the machine stalling, or the work becoming loose, you replace only that one section. Usually, due to the adjustable feature, it is possible to salvage such sections by grinding back of the break. In any event, the elimination of unnecessary waste of cemented carbide is an important factor.

Advantages of multiple-design are most important when absolutely sharp corners are required, as in Fig. 2. For the practical shop man no elaboration is necessary on the difficulty and costliness of producing these corners from a solid Carboloy tip. Not only is the production of the actual shape difficult but there is ever present the hazard that a notch-effect may check the Carboloy during any point in the production and require a complete remake. In contrast to this, the ease with which these sharp corners can be produced by means of the multiple-design is obvious. It involves simply the production of three single-point tools which can be clamped together to form the desired shape.

Multiple-design further offers flexibility where shapes and dimensions of operations are subject to frequent changes, both diametrically and longitudinally. Its possibilities are many. Frequently it happens that form tools of the conventional type, when only one half used up, have to be scrapped due to becoming obsolete. If the tools, however, are of built-up design, a large percentage of the different units can be saved. In time such an accumulation of miscellaneous tool parts should be an important factor in the reduction of future tool costs. Furthermore, this plan would make it possible to tool even small production jobs economically because part of the tool cost would have been previously absorbed by former jobs.

The same principle of multiple-design also can be quite successfully applied to circular form tools, as illustrated by Fig. 3. This tool is made in five sections, each finish ground and lapped to size before assembly.

From the foregoing, it should not be assumed that this type is recommended to the exclusion of the solid type under all circumstances. Our objective is simply to point out the features of multiple-design so that they may be considered as a possible solution to costly and difficult problems that may arise in connection with the production and maintenance of form tools employing carbide tips.

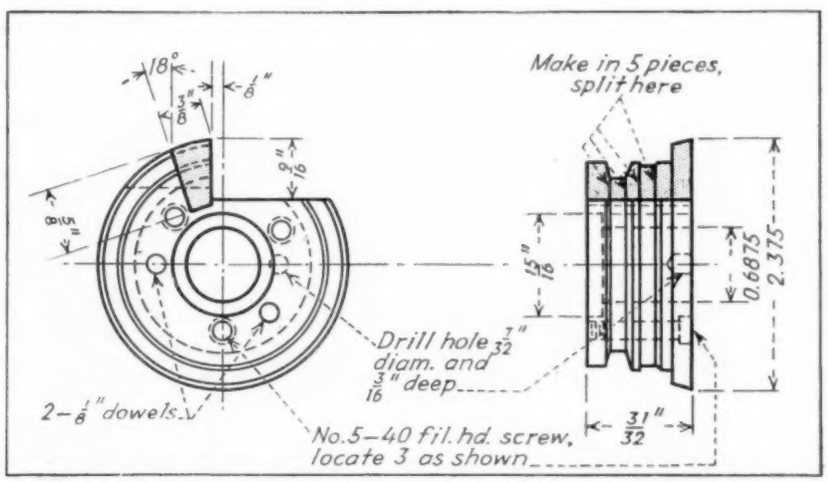


Fig. 3—Contour diameters on this circular form tool are held within 0.001 in. of the specified sizes without difficulty when the tool is made in three sections as shown

IDEAS FROM PRACTICAL MEN

Homemade Planer

F. S. McGIBBON
Lachute, Quebec, Canada

In the illustration is shown a 10 x 10 x 24-in. open-side planer which I built in my home workshop. The only work I had to have done in an outside shop was planing the ways on the bed and on the underside of the table. The planer is mounted on a bench and is driven by a $\frac{1}{3}$-hp. motor through belts, pulleys, miter gears and a screw, the motor being under the bench.

There are some parts of the planer in which the construction may seem odd, but the reason is that the only machine tools in my workshop are a bench drill and a 9-in. x 4 ft. engine lathe mounted on a bench, so I had to plan accordingly. While the frame of the planer is cast iron, all the sliding parts are cold-rolled steel pieces attached by screws and dowels and scraped to a bearing. Since the table runs on flat ways instead of V's, it is gibbed to the bed to prevent it from shifting under the cut.

The surfaces of all cast iron parts that had to be fitted together were either ground by a toolpost grinder or chipped and filed. The ones that were chipped and filed were afterward ground to their mating parts by a mixture of oil and abrasive.

In grinding with the toolpost grinder, the work was blocked up on the bench behind the lathe and the grinder was mounted on a plate attached to the toolblock so that it extended far enough from the rear of the lathe for the wheel to reach the work. Lengthwise grinding was done by traversing the carriage, while the feed was taken care of by the cross-feed screw.

Grinding Non-Metallic Rollers

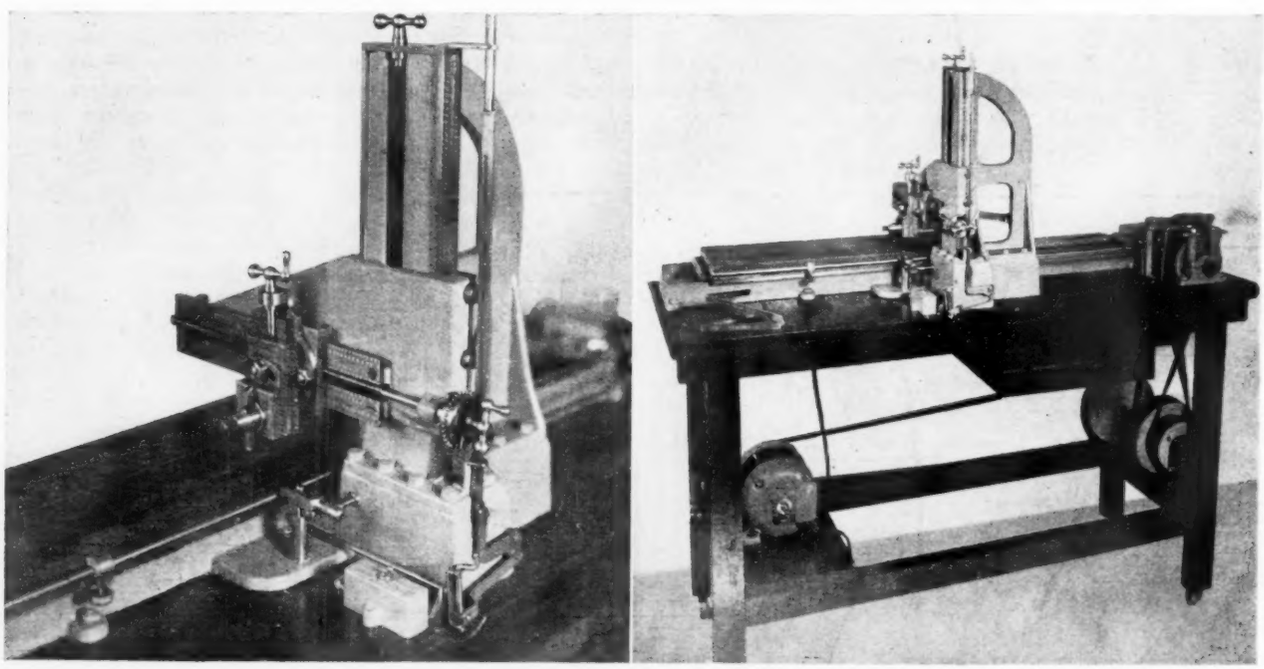
ARTHUR SILVESTER

Referring to the article under the above title by P. W. Zeigler (*AM*—Vol. 82, page 382), I have had considerable experience in grinding rollers of hard and soft rubber, compressed paper and cotton from 3 to 12 in. in diameter and from 3 to 12 ft. in length.

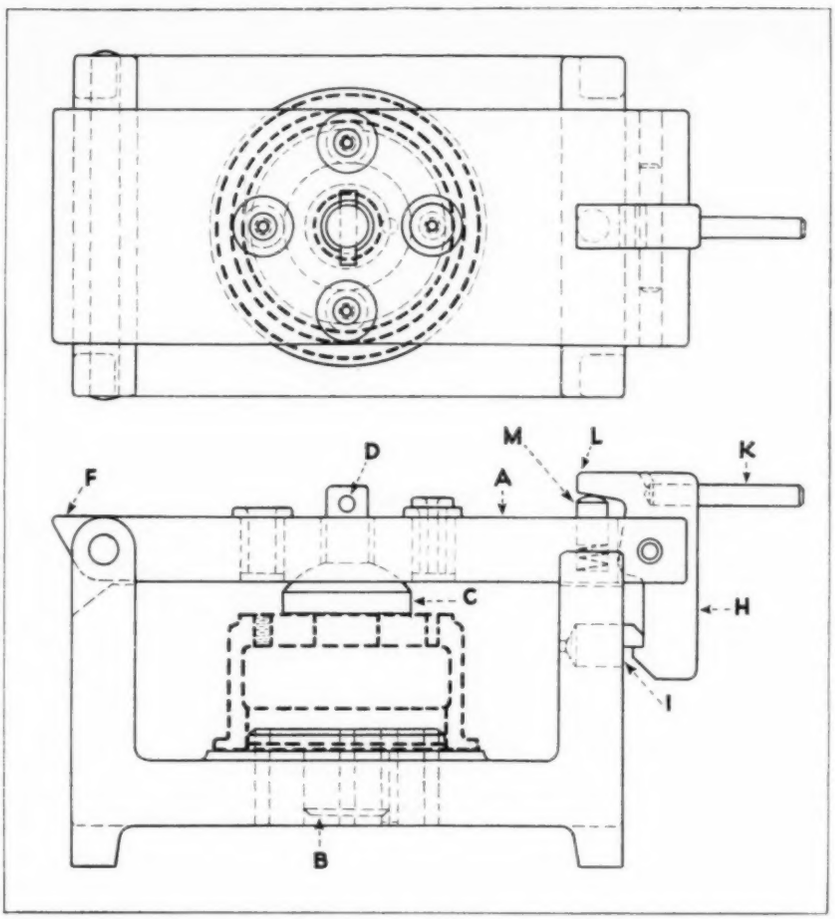
It is difficult to understand why spring calipers can be used to better advantage or with greater accuracy than the micrometer in measuring the diameter of rollers of non-metallic material. I believe it is all a matter of how carefully the micrometer is used.

I found that using a 0.002-in. feeler under the micrometer spindle was a real help. First, a careful measurement was taken, using the feeler, and then the feeler was removed, the micrometer setting not being disturbed. I found that if sufficient care had been taken I could then get neither a touch nor a feel with the micrometer. Since the micrometer was now set to plus 0.002 in. of the actual diameter of the roller, it was easy to get its correct diameter by subtracting that amount from the reading.

I found that soda water was a satisfactory coolant and that the greater the force of the stream the better it worked. It not only kept the grinding wheel clean, but it kept down the dust.



All the sliding parts of this homemade planer are pieces of cold-rolled steel attached by screws and dowels and scraped to a bearing



The work is located over a plug in the bottom of the body and is held down by a floating pad in the leaf when the leaf is closed

Leaf Jig With Floating Pad

WILLIAM B. GREENER

The jig illustrated was designed by the writer for drilling and tapping four holes for No. 10-32 screws in pump parts. It has a pivoted leaf *A* which also serves as the bushing plate.

The work, indicated by heavy dotted lines, is located over the plug *B* in the bottom of the body and is held down by the floating, self-aligning pad *C* in the leaf. The pad is prevented from falling out by the pin *D* in its stem when the leaf is opened. The leaf is made of machine steel and has a projection at *F* that acts as a stop to prevent it from swinging too far back when opened.

When the leaf is closed it is locked by the pivoted, spring-actuated latch *H* engaging the notched stud *I*. Lifting up on pin *K* causes the extension *L* to compress the spring under pin *M* and to disengage the latch from the notched stud. Pin *M* is prevented from falling out when the leaf is swung back as far as it will go because the latch is so formed that it stops in the bottom of its slot in the leaf before it can swing far enough for the extension to uncover the pin. The usual complement of slip bushings completes the jig.

Equalizing Fixture Clamp

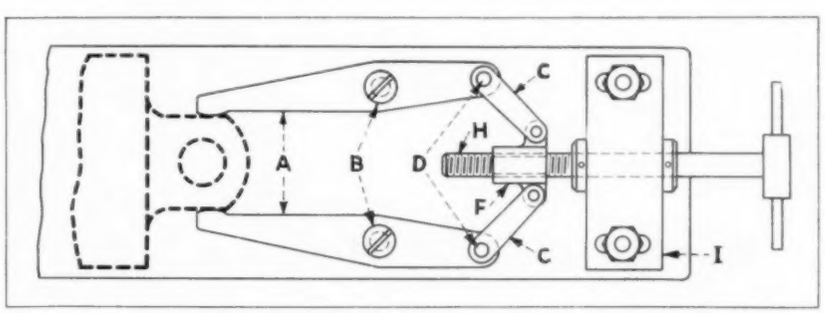
W. M. HALLIDAY

Peterborough, Northants, England

When employing stops or pins for locating rough castings in jigs and fixtures it is customary to place them slightly farther apart than the width of the work. That dimension may vary; some castings will be difficult to locate, while others will have too much clearance.

To overcome such errors in location, the equalizing clamp illustrated was devised. Two pivoted clamp arms *A* swivel on the headed studs *B*, the studs being screwed into the base of the fixture. Links *C* are connected to the rear ends of arms *A* by fulcrum pins *D*, the opposite ends of the links being connected to the nut *F* by pivot pins. Clamping screw *H* turns in block *I* which is attached to the base by studs engaging elongated holes, the purpose of which is to permit extra and quick adjustment of the clamp arms when changing from narrow castings to wider ones and vice versa. Also, by means of the elongated holes the capacity of the clamp can be extended.

It will be seen that the clamp arms operate equally and simultaneously, insuring that the work gripped will be held centrally and that variations due to rough castings will not entail difficulty in gripping them or inaccuracies on locating them for subsequent machining.



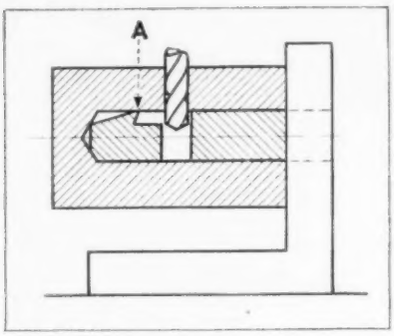
The pivoted clamp arms, actuated by a screw, grip the work simultaneously and hold it centrally regardless of slight variations in width

To Remove Burrs From Intersecting Holes

HERBERT CHASE

Where work is located in a jig by a stud engaging the larger hole, the burr made by the drill for the smaller hole breaking into the larger hole can be removed by providing the locating stud with a cutting edge. This cutting edge should be so placed that the burr will be sheared off in removing the work. It is also necessary to provide the stud with either a recess or a clearance hole where the drill for the smaller hole breaks through.

If the cutting edge is transverse to the stud, as at *A* in the illustration, the work is pulled straight off the stud. If the burr is heavy the work may have to be forced off with a lever. If the work can be rotated on the stud before it is withdrawn, the cutting edge can be lengthwise of the



By providing the locating stud with a cutting edge, the burr caused by drilling a crosswise hole will be sheared off in withdrawing the work

stud. In that case the operator must give the work a suitable twist in removing it, otherwise the burr will not be sheared off.

Profile Gaging Block

C. COLE

A gaging block for inspecting the profile of the triangular cam indicated by heavy dotted lines is shown in the illustration.

Besides being held to a limit of plus or minus 0.001 in. from the center, the edges of the cam must also be in accurate radial location to edge *A* of the work of which the cam is an integral part. That edge is located by screwing down the plunger *B* against it by the screw *C*, insuring its parallelism with the horizontal center line.

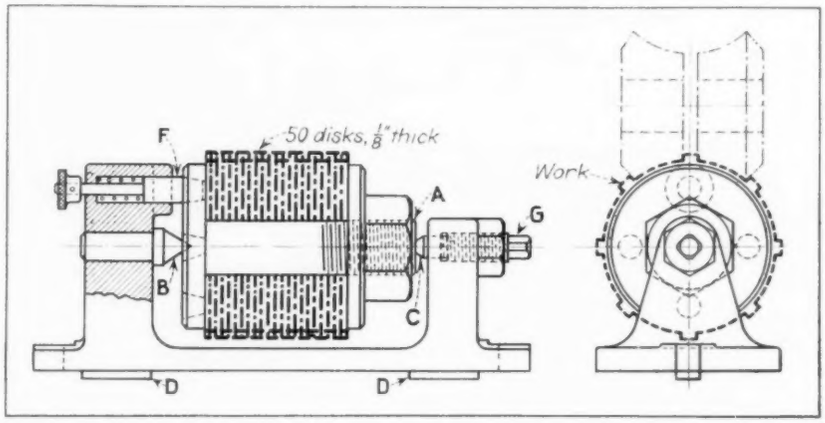
When the go end of the plug gage *D* will enter the spaces between the inner ends of the hardened and ground blocks *F* and the edges of the cam, and the not go end will not, the cam is within the required limit of accuracy.

Milling Fixture for Friction Disks

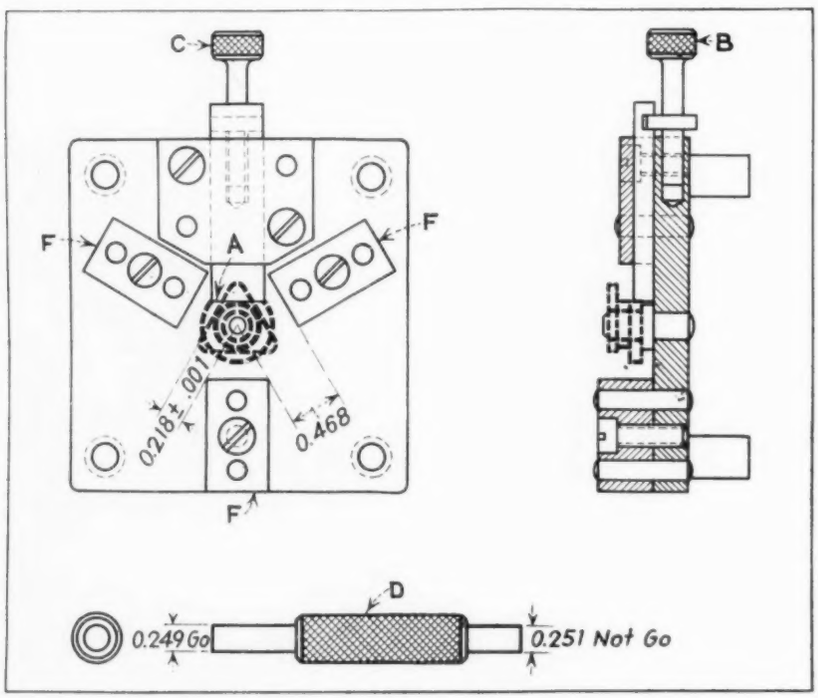
J. R. WHITTLES

A simple indexing fixture for milling the outside diameter of 50 friction disks made from rolled brass is shown. These disks are placed on a flanged mandrel *A* which is placed between the centers *B* and *C* after loading outside of the fixture. The disks are compressed between the flange on the mandrel and a washer, a nut holding them during milling.

Alignment of the fixture on the milling machine table is secured by two keys *D* that fit into the table slot. Two sections, shown in the end view, are milled at a time. Pull pin *F* is made with a taper end that fits into the four taper holes in the flange of the mandrel. The pin is withdrawn with the knurled knob and the mandrel indexed to the next locating hole. Adjustable center *C* permits the loading or unloading of the assembled mandrel and has a square end for a wrench. When proper locking tension is secured on the mandrel the hexagon nut is used to lock the center.



Where quantities will not permit the use of a punch press, brass friction disks may be milled on a simple indexing fixture



The edges of the cam, besides being a certain distance from the center, must be in accurate radial location with another edge of the work

Improving the Slide Rule

H. B. SCHELL

Most slide rules of American make do not have the constant *pi* marked on the *C* and *D* scales. It is, however, marked on the *A* and *B* scales. It is often worthwhile to add the value of *pi* to the lower scales, and it can be accurately done by the following method if care is used in transferring graduations:

Using a magnifying glass if necessary, set the left-hand index of the *B* scale to *pi* on the *A* scale and clamp the slide. Again using the magnifying glass, and with a small square and a sharp scriber, transfer the line at *pi* on the *B* scale to the *D* scale, preferably below the other graduations.

Unclamping the slide, bringing all the indices into alignment and reclamping the slide, transfer the line at *pi* on the *D* scale to the *C* scale. A slide rule having a *CI* scale can have *pi* marked on that scale by reversing the slide and transferring the *pi* line to it from the *D* scale.

AMERICAN MACHINIST *Reference Book Sheet*

Corrections for Flat Internal Form Tools

BERTIL FALCK
Tool Engineer, Eclipse Aviation Corporation

$$X = \left[a\cos B - \sqrt{a^2\cos^2 B - (2a-b)\,b}\right] \times \sin\left[90° - (B+A)\right] \quad \text{... Equation 5}$$

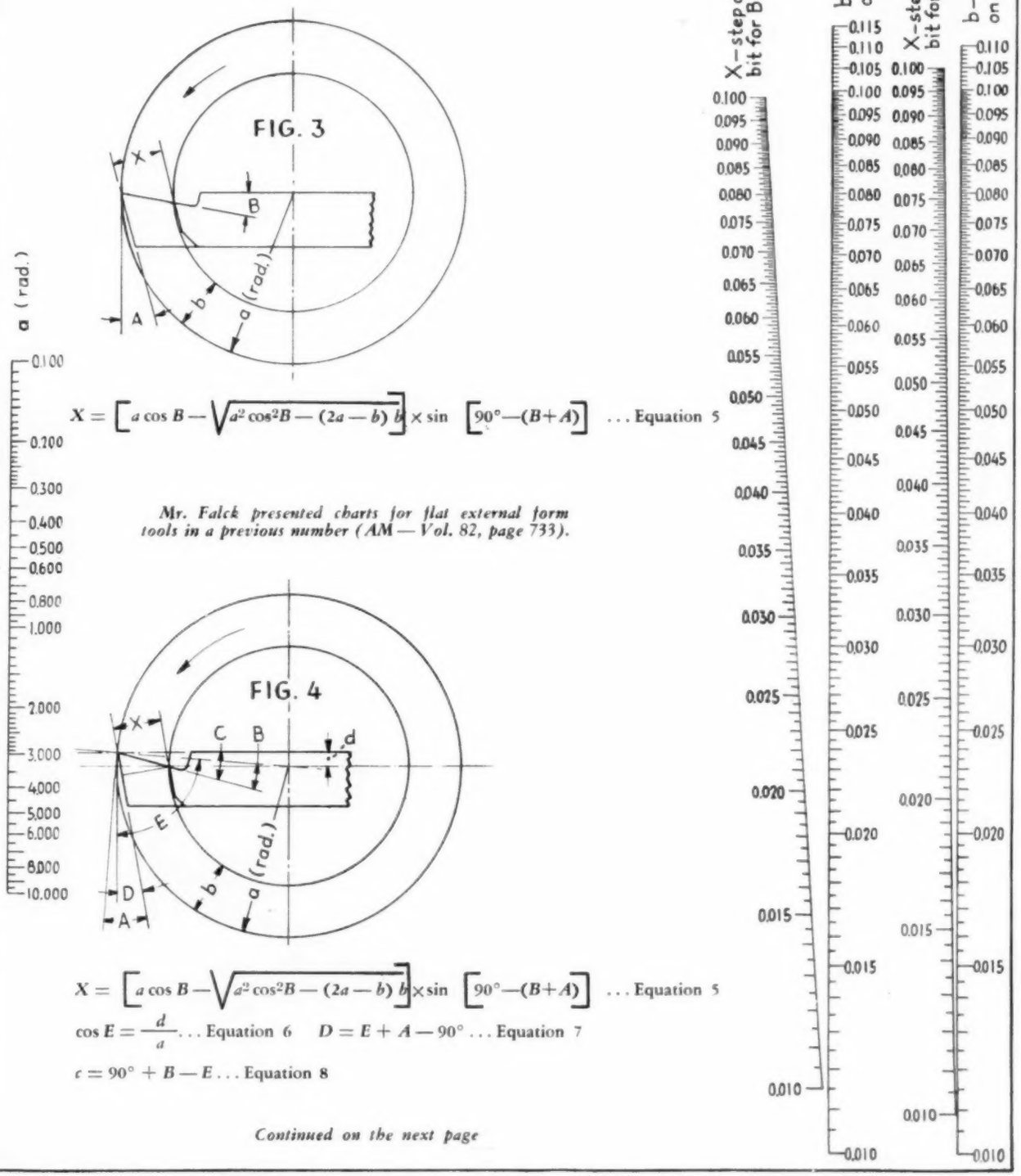
Mr. Falck presented charts for flat external form tools in a previous number (AM — Vol. 82, page 733).

$$X = \left[a\cos B - \sqrt{a^2\cos^2 B - (2a-b)\,b}\right] \times \sin\left[90° - (B+A)\right] \quad \text{... Equation 5}$$

$$\cos E = \frac{d}{a} \text{ ... Equation 6} \qquad D = E + A - 90° \text{ ... Equation 7}$$

$$c = 90° + B - E \text{ ... Equation 8}$$

Continued on the next page



AMERICAN MACHINIST *Reference Book Sheet*

Corrections for Flat Internal Form Tools

Use of Charts for Flat Internal Form Tools

Cutting on the Centerline of the Work — Fig. 3.

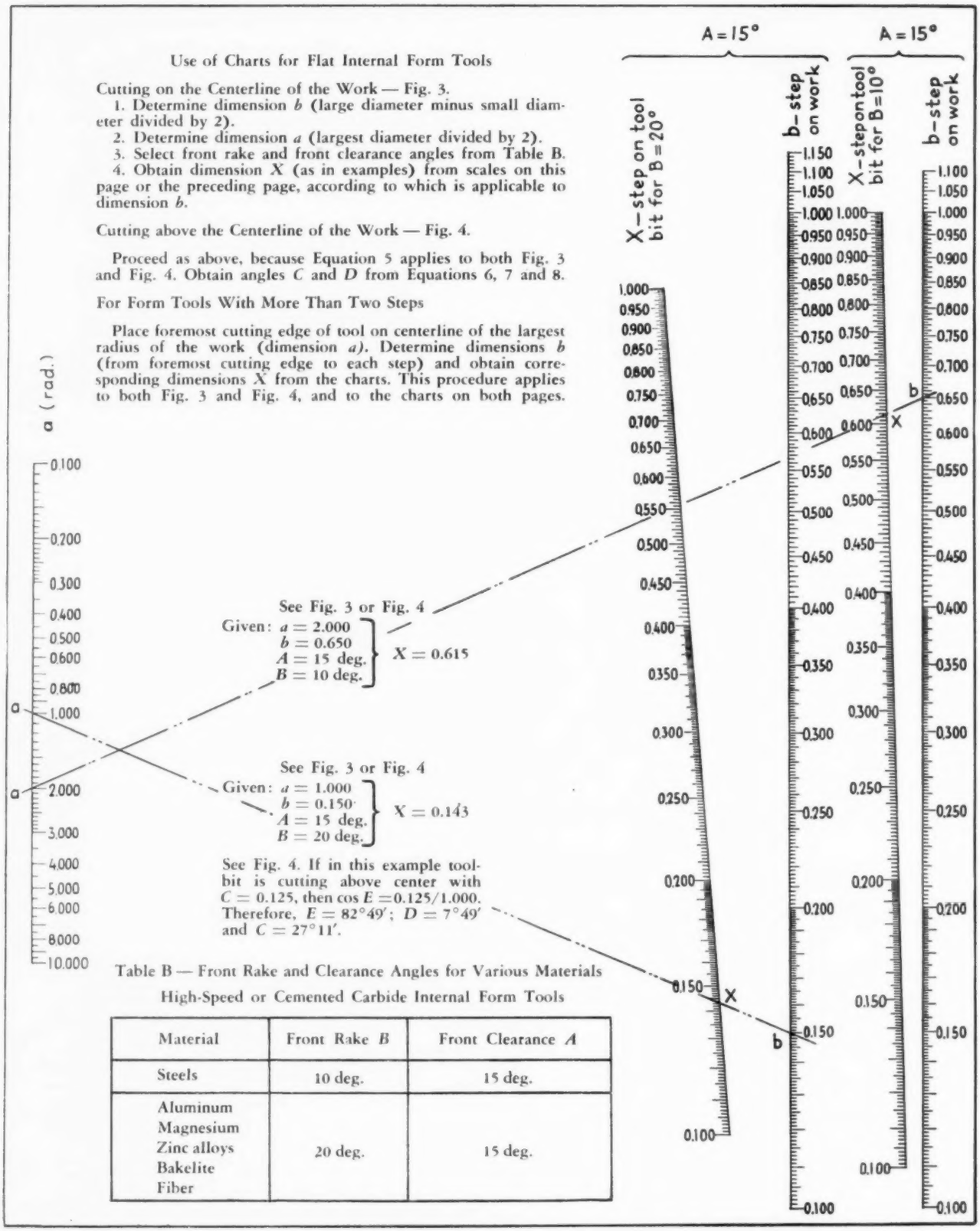
1. Determine dimension *b* (large diameter minus small diameter divided by 2).
2. Determine dimension *a* (largest diameter divided by 2).
3. Select front rake and front clearance angles from Table B.
4. Obtain dimension *X* (as in examples) from scales on this page or the preceding page, according to which is applicable to dimension *b*.

Cutting above the Centerline of the Work — Fig. 4.

Proceed as above, because Equation 5 applies to both Fig. 3 and Fig. 4. Obtain angles *C* and *D* from Equations 6, 7 and 8.

For Form Tools With More Than Two Steps

Place foremost cutting edge of tool on centerline of the largest radius of the work (dimension *a*). Determine dimensions *b* (from foremost cutting edge to each step) and obtain corresponding dimensions *X* from the charts. This procedure applies to both Fig. 3 and Fig. 4, and to the charts on both pages.



See Fig. 3 or Fig. 4
Given: $a = 2.000$, $b = 0.650$, $A = 15$ deg., $B = 10$ deg. } $X = 0.615$

See Fig. 3 or Fig. 4
Given: $a = 1.000$, $b = 0.150$, $A = 15$ deg., $B = 20$ deg. } $X = 0.143$

See Fig. 4. If in this example tool-bit is cutting above center with $C = 0.125$, then $\cos E = 0.125/1.000$. Therefore, $E = 82°49'$; $D = 7°49'$ and $C = 27°11'$.

Table B — Front Rake and Clearance Angles for Various Materials

High-Speed or Cemented Carbide Internal Form Tools

Material	Front Rake *B*	Front Clearance *A*
Steels	10 deg.	15 deg.
Aluminum Magnesium Zinc alloys Bakelite Fiber	20 deg.	15 deg.

NEWS OF THE INDUSTRY

Organized Labor Troubled by Internal Strife While Planning New Drives

C.I.O. "receivership" plan may be instituted for some U.A.W. locals and cut into Homer Martin's territory

FRANK RISING
Labor Editor, American Machinist

NEW YORK—During the hot, sticky days of late summer, with Congress adjourned, many people on vacation, and genuinely significant news hard to find, daily newspaper reporters and editors have to do the best they can to sell papers on the interest aroused in secondary matters. Which explains, in part, the great amount of type used in recent weeks to describe the Dies hearing on Fascism and Communism, the union squabble about Harry Bridges of the Pacific maritime labor set-up, the United Automobile Workers division, and a few minor strikes.

Actually, the U.A.W. split is the only event on the labor front entitled to major headlines. Unsettled and still likely to boil into bitter controversy, the automobile labor situation is bad enough to cause considerable worry both to management and responsible union leaders. At this time, it is apparent that many plants are going along on a strictly localized labor-contract basis, and that the influence of the international U.A.W. headquarters has faded to nothingness in some quarters. It is impossible to forecast the future, until majority sentiment in the union can be polled convincingly, but there are only three avenues open to the locals. These are: (1) Re-acceptance of a unified framework, under the direction of President Homer Martin or some other elected head; (2) Division into two large groups of unions, each controlling a majority membership in a number of locals and contending for the evenly divided ones; (3) Disintegration into numerous small blocs of unions, struggling with each other for jurisdiction.

It is not at all unlikely that a C.I.O. "receivership" plan will be worked out for U.A.W., or for such parts of it as can be persuaded to accept it. Such a project would not be difficult to get under way, after the Michigan elections are ended and need for ostensible unity is not so great. A group of locals need only poll their members and show that the majority is set against continued allegiance to the present U.A.W. high command, then ask C.I.O. affiliation in some other form. This would be likely to bring a speedy offer from a special C.I.O. committee to "mediate the jurisdictional dispute"—and once the receivership committee is in the picture it will not leave for a long, long time.

In following the other labor news stories of the day, the *American Machinist* reader will be advised to take a half-sack of salt or so with each dose of headlines. Communism is not rife in the C.I.O.—it is there, but in a minority position. As most informed observers know, there are some 35 C.I.O. unions, and Communistic philosophies are well rooted, with a majority leadership, in only one: the fur workers union which is confined to New York City. Even

LATE *NEWS* WIRES

DETROIT—S. L. Davis elected president and Norman De Vaux operating manager of Hupmobile. Dies, tools and jigs valued at million dollars purchased. Some from Cord Corp. Hupmobile reported planning two lines of low-priced cars in addition to present lines.

CHICAGO—National Enameling & Stamping Co. has reached wage agreement with union looking toward reopening of Milwaukee plant which expected to abandon because of labor trouble.

ST. LOUIS—St. Louis Car Co. will build steel structures for 140 streamlined noiseless street cars ordered by city of Toronto from Canadian Car & Foundry Co. The 560 traction motors and auxiliary electrical equipment will be manufactured by Canadian Westinghouse.

BOSTON—A decided pick-up is reported in textile and shoe industries with gradual recovery in electric power output. Bethlehem Shipbuilding has started work on four cargo vessels. Five million dollar subway extension is projected for Cambridge.

DETROIT—K. T. Keller's prediction at Chrysler preview that 2,750,000 to 3,500,000 cars would be sold in '39 model year is believed to reflect general feeling throughout automotive industry.

WASHINGTON—American Federation of Labor at its October convention probably will vote to demand amendment of Wagner Act transferring judicial powers from NLRB to independent tribunal. Amendment would call for review of facts as well as of law by Appellate Court. President Green says that Roosevelt is in accord on necessity of certain changes.

WASHINGTON—During July State Department issued licenses authorizing arms exports totaling $10,831,149. Arms valued at $5,600,000 were exported last month under licenses previously issued.

the Communist Party members admit this readily; they are proud of the great attention they are getting but they know they aren't entitled to such flattering notice, on the record.

One thing which has come about from the so-called revelations of Communistic activity is this: The uproar has created a crack in U.A.W. and in the Bridges domain which gives C.I.O. an opportunity it has long been looking for. And the industrial union policy-makers in the East are moving to drive a wedge into both quarters. In U.A.W. they are waiting only for the rank-and-file appeal aforementioned; in the West Coast division they already have moved in on Bridges' California industrial union council and are steering its course.

New Labor Drives

Without headlines, other events are shaping up which to date have not received the notice they deserve. Textile workers and metal workers are beginning to get preliminary arguments ready, leading to new drives on a widespread front. Sidney Hillman's campaign in textiles is under way in two divisions— cotton textiles, and woolens and worsteds. Philip Murray's steel and metal-working organization campaign has begun with new charges against Little Steel firms, and NLRB decisions on reconsidered cases against Inland and Republic will touch off a membership drive not only against all former foes but in new fields—*if* the NLRB orders are as favorable to the union as those of last spring were.

Meanwhile, strikes and "tough" labor situations continue to be at a low ebb, with fair prospect that the rest of the year will see an unusually low average of off-the-job action. There is a possibility that September may bring hand-to-hand jurisdictional battles between rival ship and dock unions on the seaboards, particularly on the West Coast, but the general tenor of union policy elsewhere is one of slow, cautious advances behind the new wage-hour rulings and such court orders as can be obtained to bolster labor.

Settlement of the most-publicized labor disputes of recent months (Philco Radio and Maytag Washing Machines) should not be expected soon, despite occasional demands made by local public officials. It is true that in both these cases the labor representatives and management are closer together, but they are not close enough at this writing to indicate early agreement. At Maytag, the workers are back on the job, but they declare that improving business conditions have removed the company's only valid reason for imposing the wage cut, and will stand fast on a demand for restitution. At Philco, the plant has been closed for four months by strike (or by lockout, depending on which side you are on). Negotiations were resumed last week after a long and silent lapse of contact, and there is some indication of better understanding.

Other and longer strikes are going on; one was ended by agreement last week in the S. W. Farber metal-working plant in Brooklyn which had run for eight months, and several small strikes have dragged on since last winter, here and there. But the net outlook is one of fairly peaceful production, and reconstruction.

All told, the labor outlook is not bad or frightening—save in one particular. That is the fight between C.I.O. and A.F.L., which at this time is growing more bitter and which may wind up in something the unions don't want: a fast play by government to bring them to heel.

Index of Machine Tool Orders

Based on Volume of Shipments for 1926

Month	Index of Orders: Domestic	Index of Orders: Foreign	Index of Orders: Total	3 Months' Average Index	% Foreign to Total Orders
1937 — July	115.4	55.7	171.1	190.5	33
August	129.5	50.3	179.8	180.9	28
September	119.0	91.7	210.7	187.2	44
October	89.1	62.9	152.0	180.8	41
November	63.3	64.4	127.7	163.5	50
December	53.5	89.2	142.7	140.8	63
1938 — January	43.2	75.2	118.4	129.6	63
February	48.7	27.0	75.7	112.3	35
March	50.5	56.5	107.0	100.4	52
April	43.9	46.4	90.3	91.0	51
May	34.8	31.9	66.7	88.0	47
June	35.7	34.5	70.2	75.7	49
July	41.8	47.8	89.6	75.5	53

Distribution of Orders

Average Index of Individual Companies Based on 1926 Level of Business	Companies in Per Cent of Total Number Reporting: 1936 4th Quar.	1937 1st Quar.	1937 2nd Quar.	1937 3rd Quar.	1937 4th Quar.	1938 1st Quar.	1938 2nd Quar.	1938 July
200–up	28.4	31.6	38.5	33.4	23.0	13.5	10.0	12.3
100–199	30.2	32.8	29.1	30.2	23.2	18.3	12.4	17.4
60– 99	19.5	16.4	15.1	15.7	18.6	19.3	19.5	13.0
20– 59	15.2	12.2	11.4	12.7	22.0	30.3	31.3	31.9
Less than 20	6.7	7.0	5.9	8.0	13.2	18.6	26.8	25.4

JAMES D. MOONEY

James Mooney Receives German Honor

James David Mooney, president of General Motors Export Co., was awarded the order of merit of the German Eagle, first class, on August 10.

In addition to his presidency of General Motors Export Co., a position he has held since 1923, Mr. Mooney is also president of Overseas Motor Corp., and is vice-president of General Motors in charge of overseas operations. He is 54 years old, has served in the U. S. Army during the World War, and at present makes his home in Cleveland.

Mr. Mooney's decoration marks the second honor recently bestowed upon American automotive men by the German government. On July 30, in honor of his 75th birthday, Henry Ford was made a member of the Grand Order of the Great Eagle of Germany, a decoration for which only foreigners are eligible.

DETROIT LETTER

Good crops and Federal funds don't mean a banner '39 season . . . But auto leaders look for a 20 per cent gain . . . New and old car stocks get almost too small for dealers . . . Chrysler's preview was ahead of the parade . . . Detroit goes back to work

DETROIT—The favorable turn in automobile sales recently and the improved situation in which dealers find themselves have not led the more sober heads in the industry to go wild with enthusiasm over the outlook for 1939. There is a feeling that business this Fall will be good, what with bumper crops and the outpouring of federal funds on a dozen fronts. But that doesn't necessarily mean that the days of 400,000-car-months have yet returned. "Restrained optimism" might be the best way to describe the studied judgment of the industry's leaders.

Beyond the first of the year these leaders have their fingers crossed. The talk heard in certain circles around southern Michigan about production of 4,500,000 cars next year is bosh. No responsible head of an automobile company is thinking in such terms. It still is true that car makers expect business in 1939 to be about 20 percent better than this year. They hope that the gain will be larger, but just now they don't see where it is coming from.

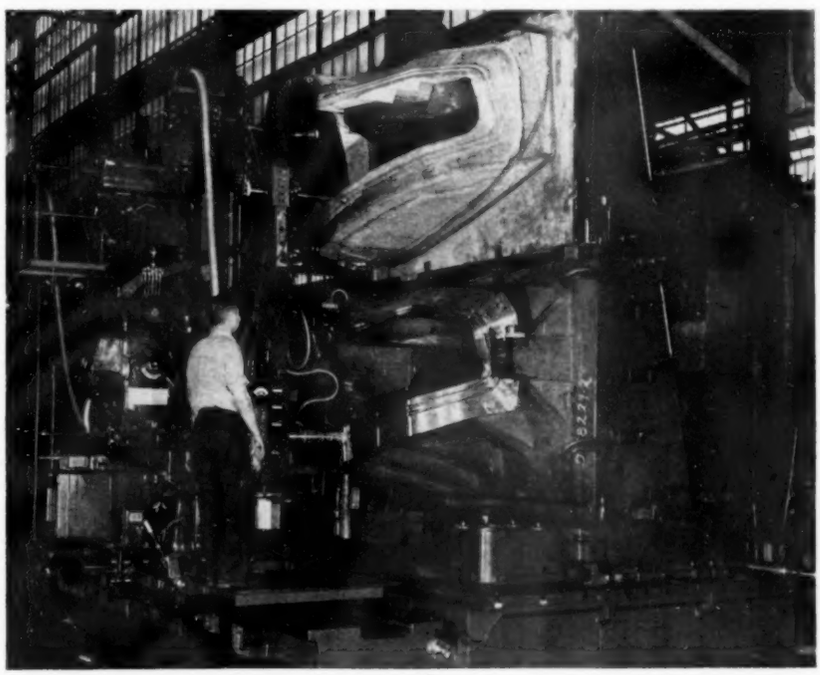
It is true that the dealer stocks are getting down to a healthy low level. It is estimated that by the time new models are ready to be shown, there is likely to be a shortage of both new cars and old cars in stock. Typical of the situation is Pontiac's experience. On August 1 its dealers had 22,825 unsold used cars in stock. On the same date a year ago the dealers had 37,069 cars. Last Spring an objective of 20,000 used cars by October was set, but unexpected improvement since then has resulted in getting the bogey down to 18,000 cars.

The fact that Chrysler divisions held a preview of their new cars on August 19 doesn't mean that there will be a rush of new car introductions in the next few weeks. Most announcements will come late in September and in October, with a few companies possibly holding out until the New York Show on November 11. Manufacture is slowly getting under way. Plymouth and Dodge are reported turning out '39 motors in an endeavor to build up a backlog for later assemblies of cars. Chrysler and De Soto will start up operations before the end of the month. Studebaker will be back in production this week after a shutdown for retooling. Ford and Willys have resumed output of '38 models and both will be out late with their '39 cars.

Despite the fact that output this month, measured in the number of cars assembled, will be small, Detroit is feeling the thrill which comes from the reenergizing of its factories. Men are being called back to work in considerable volume and parts suppliers are being pushed for deliveries of initial releases for the new cars. Anyone who is familiar with all of the difficulties that must be ironed out in starting production of a new car will appreciate what the moving ahead of schedules by even a week or two does in causing an upheaval around an automobile plant. Such an upheaval has taken place throughout the Detroit area lately, particularly in Chrysler circles.

There is still much discussion about the desirability of appealing to the man in the low income bracket with an "economy" car. However, there doesn't appear to be much chance of a change in the present line-up when the new season begins. Willys will continue to be the lowest price car aside from the Bantam (which doesn't figure seriously in sales volume). Then will come the Ford, Chevrolet and Plymouth. The idea that the Big Three will plunge into the marketing of light cars with small motors seems to be out so far as 1939 is concerned. There is some talk about cars in the Pontiac price class offering a six closer in price to the Chevrolet, but such action is not confirmed. Pontiac for several years had two sixes.

More cars the coming season will have the gear shift removed from the floor to the steering column. Body styles will resemble pretty much the Lincoln-Zephyr.



Dies for Pontiacs—This automatic Keller die cutting machine has taken a rough cut on a chrome nickel iron casting destined to become a Pontiac front fender die. After about seven days of machining, the die is accurate to within 1/16-in. of the wood model near top. Another ten days will be required to finish the die by hand

KENNETH H. CONDIT

BURNHAM FINNEY

Kenneth H. Condit, editor of *American Machinist* since 1921, and a member of the staff for two years before that, has resigned to become executive assistant to the president of the National Industrial Conference Board. He will continue with *American Machinist,* however, in an advistory capacity, as consulting editor. We know his many friends throughout the metal-working industry will join us in wishing him every success in his new work. Burnham Finney, with *American Machinist* for some years in the Detroit and New York offices, and co-editor with Mr. Condit for the past year, succeeds him as chief editor.

Mr. Condit received the degree of mechanical engineer from Stevens Institute of Technology in 1908 and the degree of civil engineer from Princeton five years later. During the interim he had spent three years in various production and sales capacities with Safety Car Heating & Lighting Co., A. G. Spalding & Bros. and White Motor Co. From 1913 to 1917 he remained at Princeton as instructor in civil engineering, then resigned to enter the Air Service, U. S. Army, in which he was ultimately commissioned as captain. He joined McGraw-Hill Publishing Company immediately upon his resignation from the Army. In 1929, when *Product Engineering* was established as a separate publication, Mr. Condit became its editor as well, serving in that capacity until 1935.

For many years Mr. Condit has been prominent in the American Society of Mechanical Engineers, serving on the Executive Committee of the Machine Shop Practice Division and as chairman of the standing committees on awards, publications and professional divisions. More recently he has been a member of the Executive Committee of the A.S.M.E. Council, also the Society representative on the United Engineering Trustees, Engineering Foundation and National Management Council.

Mr. Finney, upon graduation from the University of Cincinnati in 1921, spent four years as executive secretary for several Cincinnati business organizations and in conducting a business-news bureau. During this period he also served as correspondent for *American Machinist.* From 1925 to 1929 he was Cincinnati editor for *Iron Age* and for a time on the New York staff of that publication. After a short interval as sales promotion manager for the Armco Culvert Manufacturers' Association, he returned to the *Iron Age* as Detroit editor, which position he retained until his resignation to become Detroit editor of *American Machinist* in January, 1936. He was transferred to the New York office with the title of editor in October, 1937.

Two further staff changes have been made. H. R. LeGrand, who joined *American Machinist* as assistant editor in 1928, with a year's industrial experience after graduation with a B.S.M.E. degree from Newark College of Engineering, has been transferred to Detroit as resident editor there. He will report on manufacturing developments throughout the Detroit-Cleveland area. W. W. Horine, who was graduated from Georgia Institute of Technology last year with a B.S.M.E. degree, and who has spent the intervening year in the test departments of the General Electric Company at Schenectady, Erie and Pittsfield, has joined the staff as assistant editor, handling news and detail assignments.

Further additions are now in process to round out one of the largest and best informed staffs on any metal-working publication, equipping it to render the ever-greater service demanded by an industry in which technical developments and process improvements are occurring with constantly increasing frequency.

Under the leadership of Mr. Finney, and with the assistance of Mr. Condit, we feel assured that *American Machinist* and its staff will go on to a continually enlarging sphere of usefulness to their readers.

H. O. Wyckoff

Publisher

WATCHING WASHINGTON

Metal-working industries not immediately effected by labor standards act . . . Andrews setting up information section to clarify law . . . Difficulty in appointing labor delegates probable . . . Breathing spell for utilities seen . . . Importance of trade associations recognized

McGRAW-HILL WASHINGTON BUREAU
(Paul Wooton, Chief)

WASHINGTON—The statutory 25-cent wage minimum and 44-hour maximum under the labor standards act becomes effective automatically October 24. But there is almost no possibility that the Administrator will call for committees to set higher minima in the metal working industry in the near future. For one thing, Administrator Elmer Andrews says definitely he does not intend to clutter up his Labor Standards Division with more than three or four simultaneous industry studies. Second, there are other industries which the government feels are in need of wage adjustment, whereas metal working is rarely if ever mentioned here in that regard.

Companies which will have to cut hours to meet the 44-hour maximum will have the choice of (1) leaving the hourly wage as is, thereby reducing the employees' real wages, or (2) raising rates so that employees will receive the same pay envelope for less hours. Western Union, for one, has already anonunced it will take the first course. Andrews admits that while the law exhorts against this tactic, it has no preventive or punative provision. But Washington agents of metal working say that very few units of the industry working over 44 hours will move to reduce real wages. Reason: brighter business outlook; and willingness of most employers to go a long way before inviting government supervision.

Mr. Andrews' Policies

After attending the swearing in of Mr. Andrews, and sitting in a press conference with him, this writer has several points that seem worth passing on to employers.

Those who thought, and there were many, that Secretary Perkins would administer the wage-hour law by proxy, are definitely mistaken. Andrews will run his own show beyond any doubt.

The Administrator is by no means a pro-labor fanatic. Labor and industry representatives here believe they will get fair consideration of whatever matter comes before him.

In this Capital, where many political appointees take office in total ignorance of the job to be done, Andrews is an outstanding contrast. From long experience, he talks industry problems as glibly as some old manufacturer.

Andrews' policy will be to clarify the law as rapidly as possible through newspapers and trade papers. He is setting up an information section now, and anybody can get simplified analyses of the act as interpretation progresses.

One tough problem for the wage-hour administration will be the appointment of labor delegates to industrial committees satisfactory to both AFL and CIO. Andrews says he will try to get agreements from the two labor groups in advance of appointments. (Bear in mind that industrial committees are concerned with wages only—hours are statutory). Committees will be composed of labor, employer, and public representatives. Only public representatives may serve as chairmen.

Andrews is fairly well pleased with the wage-hour law, but thinks it can and will be improved. American Federation of Labor will try to remove from the law the regional differential provisions and also the authority which is given to the Labor Relations Board concerning exemption from overtime by agreement with certified unions.

Wartime Ships

The Maritime Commission has invited bids on two ships and a hull of its laid-up wartime fleet. Purchasers will be forbidden to operate the bottoms in foreign service; they may go to scrap. Reasons why the tied-up ships are being sold singly instead of en masse; they would glut the tonnage market and impede the government's ship-building program; the ancient fleet could be commissioned to serve in trade and war emergencies.

Breather for Utilities

Some conservative New Dealers here are saying that the Administration should let up on the electric utilities and get on the railroad dilemma. It is said that Douglas of the Securities & Exchange Commission thinks the utilities can contribute much to recovery if let alone by politicians. Likewise Jesse Jones of Reconstruction Finance Corporation believes public interest in the railroads should be served.

More Questionnaires

Trade associations will play an important part in the antimonopoly investigation. Commerce Department's three or four thousand questionnaires to association executives early next month, are being prepared in consultation with Justice Department, Federal Trade Commission and other government agencies, so that only one inquiry to the trade group will be necessary. Commerce has planned the questions so that they can be answered out of knowledge and office files, without requestionnairing members. Harvest machinery, patents, and munitions are chief among those concerned about the antitrust drive.

A TORY UPSET

A House Rules Committee more tractable to the Administration will come about through the primary defeat of Rep. William J. Driver of Arkansas. A recount in his congressional district gave the nomination to a young New Dealer by a narrow margin. A rubber stamp is certain to fill Mr. Driver's place on the Committee, when the House Steering Committee makes the appointment.

Most other Tory members of the Rules Committee have already been renominated, with the exception of Representatives O'Connor of New York and Cox of Georgia. But even if these men are returned by their constituencies, the balance of power on the Committee has been changed by Mr. Driver's defeat. Decisions adverse to the President have been very close. Appointment of an Administration 100 per center will have an important effect on much legislation vital to business, such as that affecting patents, wages and hours, and labor relations amendments.

Construction Started on New Carboloy Plant

DETROIT—Construction of a new Detroit factory and general offices for Carboloy Co., Inc., manufacturers of cemented carbide tools and dies, was started Aug. 10, it was announced by the company.

The new plant, costing about $700,000, will bring under one roof the entire manufacturing facilities of several plants now located at Cleveland, Stamford, and Detroit. The structure is being built by the O. W. Burke Co. of Detroit, under the supervision of the General Electric Realty Corp., and is expected to be ready for occupancy by the first of the year. Included in the specifications are a complete hydrogen producing plant and air-conditioned offices and raw materials processing rooms.

Stockholders Approve Steel Merger

At special meetings in Pittsburgh and Pompton Lakes, N. J., stockholders of the Allegheny Steel Co. and the Ludlum Steel Co. approved plans for the proposed merger of their companies. The $31,850,000 organization resulting from the consolidation will be known as the Allegheny Ludlum Steel Corp.

The new organization will devote its manufacturing activities primarily to supplying alloy steels. To accomplish this it will operate plants in Brackenridge and West Leechburg, Pa., Watervliet and Dunkirk, N. Y., Wallingford, Conn., and Detroit, Mich.

President of the new corporation will be Hiland G. Batcheller, former president of Ludlum. W. F. Detwiler, former Allegheny president, will serve as chairman of the board. A statement issued by them said that the new company will represent a merger of both the "assets and personnel" of the parent companies.

Foundry Equipment Orders Up Over 20 Per Cent

CLEVELAND—The index of net orders for foundry equipment rose from 61.2 for June to 74.2 for July, according to data released by the Foundry Equipment Manufacturers Association. This represents an increase of 21.2 per cent in one month, although orders are considerably below those for the same month last year, when the index stood at 204.

The index for shipments was at 105.8 for July as against 78.5 for June, an improvement of about 35 per cent. This still compares unfavorably with last year's showing, when the July shipments index was 216.5.

In contrast to the above trends, unfilled orders decreased appreciably, the index being 108.6 for July as compared with 140.2 for June, a drop of some 23 per cent. The three months average of gross orders changed very little during the past month, dropping from 77.3 to 76.0, a decline of less than 2 per cent.

U. S. Government Contracts Awarded to Metal-Working Firms

(Awarded from Aug. 5-11 inclusive)

Contractor	Govt. Agency	Commodity	Amount
Gardner-Denver Co.	Farm Sec. Admn	Air compressor	$21,870
Allis-Chalmers Mfg. Co.	Farm Sec. Admn	Tractor	68,925
The Union Diesel Engine Co.	Navy, S & A	Marine diesel engine	33,797
Ex-Cell-O Aircraft & Tool Corp.	War, Ordnance	Shell turning mach	55,408
The Bullard Co.	War, Ordnance	Chucking machine	36,548
Jones & Lamson Machine Co.	War, Ordnance	Turning lathes	54,876
Lippmann Engineering Works.	Farm Sec. Admn	Rock crushing plants	20,128
The Jaeger Machine Co.	Farm Sec. Admn	Concrete mixers	45,022
Singer Sewing Machine Co.	Farm Sec. Admn	Sewing machines	111,075
Consolidated Sewing Machine & Supply Co., Inc.	Farm Sec. Admn	Sewing machines	27,829
Delta-Star Electric Co.	TVA	Disconnecting switches	21,586
Aluminum Co. of America	TVA	Electrical conductor	#34,987
Allis-Chalmers Mfg. Co.	TVA	Generators	1,437,401
Continental Motors Corp.	Commerce	Engine generator plants	60,320
Leeds & Northrup Co.	TVA	Temperature recorders	19,400
General Electric Co.	TVA	Control switchboards	40,917
General Electric Co.	TVA	Telephone systems	74,000
International Harvester Co., Inc.	Farm Sec. Admn	Trucks	34,920
International Harvester Co., Inc.	Post Office	Trucks	100,100
The Corbitt Co.	War, QMC	Truck chassis	92,005
International Harvester Co., Inc.	Farm Sec. Admn	Trucks	24,624
International Harvester Co., Inc.	Farm Sec. Admn	Trucks	45,324
United States Gauge Co.	Navy, S & A	Gauges	30,136
Scovill Mfg. Co.	War, QMC	Buttons	55,916
The Carborundum Co.	Navy, S & A	Cloth, abrasive	23,896
Enterprise Engine Corp.	War, Engineers	Servicing generating set	27,935

Estimated.

Foreign Buyers Taking Heavy Machine Units

NEW YORK—While the export market for small and medium sized metal-working units continues spotty, a number of orders for heavy-duty units has been placed by British, French and South American purchasers; other such orders still are in the negotiation stage. These are mostly for railroad and other maintenance purposes; many of them being of the rebuilt variety because of cost and delivery factors.

Reports indicate that the Japanese exchange situation has eased considerably and that much general-purpose metal-working equipment now is on order. Rumor has it that a large order for used lathes, automatic milling machines and other equipment for small arms manufacture now is being negotiated for early delivery to this country. This order probably will total somewhere in the neighborhood of $300,000–$400,000.

At least one German representative with headquarters in Japan now is in this country looking for connections with American concerns making special machinery and accessories. Delivery and exchange difficulties now being experienced by German manufacturers of such equipment indicate possibilities of an increased market for U. S. manufacturers.

The Latin American market for new equipment is little changed, but at least one exporter of used metal-working equipment in the small and medium sizes is finding this market quite active. He has sold more to customers in the Argentine during the past five months than during any similar period for a number of years.

Local exporters specializing in the Latin American market do not expect much to come of the presently reported internal agitation in Equador to influence the Constitutional Congress to repeal the import license law. Reports indicate that both Japan and Germany have profited through the application of this act at the expense of U. S. traders. Recent tariff increases announced by the Mexican government are not expected to affect the metal-working machinery market there.

While India remains an agricultural country, its metal-working industry has grown rapidly during recent years and some exporters, particularly of light-duty, inexpensive equipment, are finding this a good market. H. S. Malik has recently opened an office in New York as the India Government Trade Commissioner to this country.

PERSONALS

FRANK D. NEWBURY has been appointed manager of the new products division of Westinghouse Electric & Manufacturing Co. to succeed the late Herbert Mygatt Wilcox, it was announced recently by George H. Bucher, president of the company. In addition to his development of activities in new fields, Mr. Newbury will continue his present duties as economist for the company.

Born in Brooklyn, N. Y., and graduated as a mechanical engineer from Cornell University in 1901, Mr. Newbury has occupied a number of positions from apprentice to general manager of machinery engineering. In 1935 he was appointed assistant to the vice-president, and later became company economist, a position he has held until his recent promotion.

PAUL APPENZELLAR has been elected chairman, Dictaphone Corp. He succeeds the late RICHARD H. SWARTWOUT.

CARL BREER, of Chrysler Corp., has been elected to the American Standards Association. Mr. Breer, an executive engineer and a member of the board of Chrysler Corporation, was nominated by the Automobile Manufacturers Association. He is also a member of several other prominent organizations, which include the A.S.M.E., the Society of Automotive Engineers, the National Research Council, and the American Institute of Physics.

LOUIS F. DAVIS, formerly with Philco Radio & Television Corp., has been made vice-president and treasurer, McAleer Mfg. Co., Philadelphia. He will also act as general manager.

RALPH E. DAY, president and general manager of the Bridgeport Brass Company, and PERRY D. SAYLOR, chairman of the board of the Canadian Dry Ginger Ale Co., have been named directors of the Gray Telephone Station Co., Hartford. WALTER E. DITMARS, New York, was also elected a director.

F. H. DOREMUS has been appointed Rocky Mountain district manager of the industrial department of the General Electric Co., according to an announcement made recently by A. L. Jones, commercial vice-president. Mr. Doremus' promotion came sixteen years to the day after he had first become associated with the company as a test man at the Schenectady works. He will succeed HENRY C. GLAZE, whose voluntary retirement after 39 years of service became effective Aug. 1.

J. M. FRANK, president, Ilg Electric Ventilating Co., Chicago, is chairman of a new educational committee of the American Society of Heating and Ventilating Engineers which is "to define more clearly the scope and meaning of the term 'air conditioning'" and the service to which the public is entitled from the various types of systems.

NEIL S. GARDNER was recently appointed production manager, Covered Wagon Co., trailer coach manufacturers, Mount Clemens, Mich.

FRANK D. NEWBURY

E. J. REARDON

EUGENE W. RITTER

E. J. REARDON, superintendent of the American Steel & Wire Co., New Haven, Conn., has been appointed general superintendent with offices at New Haven, and will also have jurisdiction over the Trenton, N. J. works. S. B. METCALF, general foreman at New Haven, has been named superintendent of the Trenton plant. R. MURRAY, general foreman of the wire department at New Haven, has been promoted to be assistant superintendent at New Haven. American Steel & Wire Co., is a United States Steel Corp. subsidiary.

EUGENE W. RITTER has been appointed general manager of the C.R.A. Manufacturing Company's tube making plant at Harrison, N. J. Mr. Ritter was formerly manager of research and engineering, a post to be filled by D. F. Schmit, who was previously in charge of cathode ray tube development and design.

EDWARD G. HACKBARTH, assistant to the president of Peck, Stow & Wilcox, Southington, Conn., hardware manufacturers, has been elected vice-president and assistant treasurer. S. C. WILCOX, secretary of the company, was elected treasurer, and will also continue his duties as secretary. The changes follow the retirement of CHARLES F. TREADWAY, who resigned recently as vice president and treasurer.

P. A. STYAN has been appointed assistant manager of Western Steel Products Ltd., Granville Island, Vancouver. He was formerly purchasing agent for the western division of the company, with its headquarters at Winnipeg, and has been associated with the organization for the past 15 years. He has already arrived in Vancouver to assume his new duties.

W. A. DANNER will be district manager of the American Rolling Mill Company's new district sales office to be opened in Minneapolis on September 1. Mr. Danner, who has been associated with the company for the past 16 years, will be assisted by S. A. Yager, a member of the chicago district office organization and recently located in Minneapolis.

HARRY O. MUNN, formerly chief service engineer of the Lindberg Engineering Co., Chicago, Ill., has been put in charge of the company's recently opened office in Buffalo.

BUSINESS ITEMS

The Salem Engineering Co. of Salem, Ohio, manufacturers of industrial heating equipment, announce the appointment of William N. Goggin as their Chicago district sales representative. F. R. Wilson has been named representative in the Detroit district.

The North American Aviation Co., of Los Angeles, Calif., is erecting an addition to their warehouse, costing $10,000.

The Morey Machinery Co., Inc., has been appointed exclusive agent in the liquidation of the real estate and manufacturing equipment of the Pierce Arrow Motor Corporation. The Pierce Arrow equipment has a present depreciated value of about two and a half million dollars and represents an initial investment of over $10,000,000.

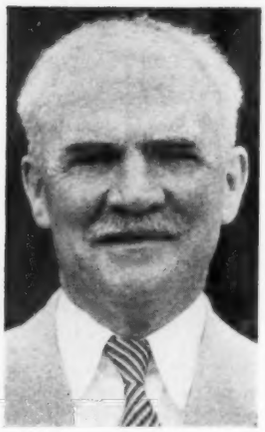
Arthurdale Farm Equipment Co., organized by settlers in the Arthurdale Homestead project with aid of Government which supplied $125,000 for construction, is to take over the manufacture of the Co-op tractor, according to F. S. Hutty, manager, Co-Operative Mfg. Co., Battle Creek, Mich.

The Superior Tank Construction Co., of Los Angeles, Calif., is erecting a new shop at a cost of $16,000.

Milcor Steel Co., Milwaukee, has purchased a warehouse from General Electric Co. in Rochester, N. Y. for purposes of serving New York and Northern Pennsylvania. It is expected to be opened in September.

The Connecticut Blower Co. of Hartford announces the opening of a new district office with headquarters at 155 E. 44th St., New York City. J. G. STALB has been appointed district manager to cover Southern New York State, Long Island, New Jersey and Delaware. The company also announces five additional sales engineers for the states of Michigan, Pennsylvania, Texas, Indiana and Illinois. The engineers for these territories are, respectively: CARL E. SWIFT, JOHN P. GILBOY, MARTIN E. MARSALIS, CHARLES E. KREIPKE and CHESTER J. SCANLAN.

FINLEY P. MOUNT



GEORGE R. RAYNER

Neff Kohlbusch & Bissell of Chicago has been appointed exclusive agent in the Chicago and Milwaukee territory for the sale of Hydro-Pierce machines, made by the Mid-West Production Engineering of Detroit.

The Lidgerwood Mfg. Co., Elizabeth, N. J., has received the contract for the electro-hydraulic steering gear and the deck machinery for a third 18,500-ton turbo-electric tanker to be built for the Atlantic Refining Co., at the Sun Shipyards in Chester, Pa. The new welded tanker will be the seventeenth electrically propelled ship designed by Atlantic engineers during recent years.

Celluloid Corporation has appointed Plastic Industries, Ltd. of Montreal as its Canadian agent, according to an announcement made by G. H. Boehmer, general sales manager for the former concern.

OBITUARIES

FRED BUCK, president and general manager, Lufkin Rule Co., Saginaw, Mich., died August 12 at the age of 80. Mr. Buck had been general manager of the company since 1885 and its president since 1914. In addition, he was president of the Luskin Rule Co., Ltd. of Canada, and a director of the Michigan Manufacturers Association.

FINLEY P. MOUNT, president, Advance-Rumely Corp., agricultural machinery, died August 7 at the age of 72. Named receiver of the company in 1915, he became its president in 1916. He was a former president and an honorary life member of the Farm Equipment Institute.

GEORGE C. PHILLIPS, since 1935 production standards engineer of the Fisher Body Pontiac plant, was buried Aug. 12. He died at the age of 51.

ROBERT H. HILL, president of the Hill Bolt Corp., died at his home in Detroit after a long illness and was buried on Aug. 10. He had been vice-president and general manager of the American Nut Co. of Detroit before founding his own firm.

JOHN A. MACLEAN, president since 1926, MacLean-Fogg Lock Nut Co., railway supplies, Chicago, died August 13 at the age of 64.

GEORGE R. RAYNER, executive vice-president of the Carborundum Company and prominent Niagara Falls industrial leader, died at his home in Lewiston Heights, August 15th after an extended illness dating back to July, 1937.

Mr. Rayner was born in Northampton, Mass., August 6, 1871 and has been connected with the Carborundum Company since August, 1898, when he came to Niagara Falls as secretary and general sales manager, following a period of sales activity in the Chicago territory. Shortly after the World War he was elected vice-president of the company, which position he held until his death.

WILLIAM H. BOWE, president of the Herrick Company, Boston, and a past president of the New England Iron & Hardware League, died at Winchester, Mass., on August 14 at the age of 69.

BENJAMIN D. BROWN who retired July 19 as president, Albion Malleable Iron Co., Albion, Mich., died August 6 at the age of 55. He had been with the company for 30 years and was formerly treasurer, Union Steel Products Co. of Albion.

DAVID CAESAR, general manager of Harnischfeger Corp., Milwaukee, for 20 years prior to his retirement three years ago because of illness, died August 5 at the age of 59.

FERDINAND CHARLES LAU, nationally known metallurgist and one of the founders of the American Society for Metals died August 10 at the age of 79. After his retirement from active business he acted as a consultant on the staff of Bausch & Lomb.

FRANK MATTERN, president, Mattern Co., manufacturers of X-ray equipment, Chicago, died August 7 of burns received in a gasoline explosion aboard a cabin cruiser. He was 37 years of age.

WILLIAM H. J. FITZGERALD died Aug. 9 in Weymouth, Mass., at the age of 71. Mr. Fitzgerald had been prominently associated with the machine-tool industry for many years, having been purchasing agent for the United Shoe Machinery Co. of Beverly, and later engaged in selling machine-tools in Boston. More recently he served as president and general manager of the Pneumatic Drop Hammer Co., Braintree, Mass.

GEORGE A. PRIOR, vice-president and director of the Gray & Prior Machine Co., Hartford, Conn., died August 1.

CARL H. SWARTZ, vice-president, Stover Mfg. & Engine Co., Freeport, Ill., died August 15 at the age of 53.

MEETINGS

AMERICAN FOUNDRYMEN'S ASSOCIATION, Michigan Union Building, Ann Arbor, Michigan, September 15, 16 and 17. Committee Chairman, PROF. RICHARD SCHNEIDEWIND, University of Michigan.

AMERICAN GEAR MANUFACTURERS ASSOCIATION, Skytop Lodge, Pocono Mountains, Pa., Oct. 10, 11 and 12. Secretary of the Association: J. C. MCQUISTON, Shields Building, Wilkinsburg, Pa.

AMERICAN HOT DIP GALVANIZERS ASSOCIATION. Semi-annual meeting, Aug. 25 and 26, Statler Hotel, Cleveland. STUART J. SWENSSON, secretary-treasurer.

AMERICAN IRON AND STEEL INSTITUTE and AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS. Joint Meeting with two British Institutes: THE IRON AND STEEL INSTITUTE and THE INSTITUTE OF METALS, Hotel Waldorf-Astoria, New York City, beginning Oct. 3.

AMERICAN SOCIETY FOR METALS. Twentieth Annual Metal Show and Exhibition, Convention Hall, Detroit, Oct. 17–21. W. H. EISENMAN, secretary, 1016 Euclid Ave., Cleveland, Ohio.

AMERICAN SOCIETY OF TOOL ENGINEERS. Semi-annual meeting, Oct. 14–15. Pittsburgh, Pa.

NATIONAL ASSOCIATION OF FOREMEN, Dayton, Ohio, October 14, 15 and 16.

NATIONAL INDUSTRIAL ADVERTISERS ASSOCIATION. Sixteenth annual conference, Sept. 21–23. Statler Hotel, Cleveland. Committee chairman, STANLEY A. KNISELY, advertising director, Republic Steel Corp.

NATIONAL SAFETY COUNCIL. National Safety Congress, Oct. 10–14. Stevens Hotel, Chicago.

NATIONAL SMALL BUSINESS MEN'S ASSOCIATION, Pittsburgh, Pa., September 13–16.

PORCELAIN ENAMEL INSTITUTE. Third annual forum, October 12–14. University of Illinois, Urbana, Illinois, Committee Chairman, F. E. HODEK, JR., General Porcelain Enameling and Manufacturing Co.

Eighth annual meeting, October 25 and 26. Cleveland.

SEVENTH INTERNATIONAL MANAGEMENT CONGRESS, Washington, D. C. Sept. 19–23.

SOCIETY OF AUTOMOTIVE ENGINEERS. Section regional tractor meeting, Sept. 8 and 9, Minneapolis, Minn.

National truck, bus and rail car meeting, Oct. 4 and 5, Chicago.

National regional fuels and lubricants meeting, Oct. 6 and 7, Tulsa, Okla.

National aircraft production meeting, Oct. 13–15, Ambassador Hotel, Los Angeles, Calif.

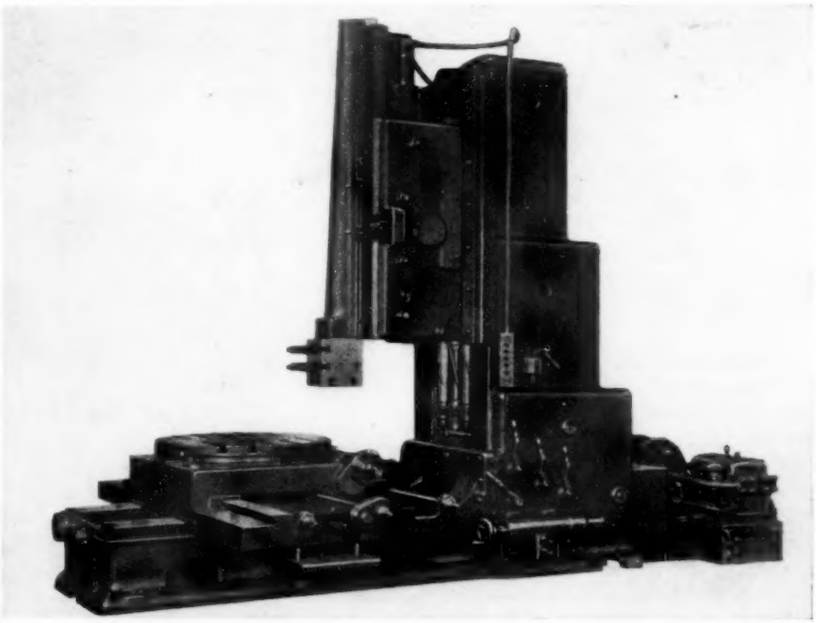
SHOP EQUIPMENT NEWS

Rockford "Hy-Draulic" Slotter

Hydraulic drive to the ram and hydraulic feeds are featured in the 20-in. "Hy-Draulic" slotter with 36-in. maximum stroke offered by the Rockford Machine Tool Co., 2420 Kishawakee St., Rockford, Ill. Application of hydraulic power to the ram is direct, and speed and pressure are constant throughout the cutting stroke. Unlimited selection of speeds or feeds throughout the range of the machine is secured by simple adjustment of control handwheels. Hydraulic feed to the table is provided in all directions: longitudinal, transverse and rotary. A built-in dividing head for accurately indexing the table when cutting gears or spacing keyways can be disengaged when not in use.

Strokes as short as 6-in. can be taken at full cutting speed without shock. Length of ram stroke and its position relative to the work can be adjusted quickly in one operation without cranking or using tools. Clapper box relieves tool on the return stroke. Tool head can be removed for mounting tools directly on the ram.

Specifications: rated size, 20 in.; maximum stroke, 36 in.; minimum stroke, 6 in.; slots to center of 83-in. diameter circle; maximum distance under adjustable ram guide, 40 in.; maximum distance under fixed ram guide, 30 in.; range of cutting speeds, 0-80 ft. per min.; range of ram-return speeds, 0-150 ft. per min.; maximum cutting pressure, 10,800 lb.; vertical movement of adjustable ram guide. 16 in.; cross travel of table, 36 in.; longitudinal travel of table, 42 in.; range of table feeds, 0-01.140 in. per min.; diameter of table, 42 in.; distance from floor to top of table, 36 in.; floor space required, 8½x16 ft.; net weight, 34,000 lb. In the universal model, the ram may be tilted forward any amount up to 10 deg. and easily-read graduations show the amount of inclination. Clamps hold the slide securely in the adjusted position.



Hydraulic power is applied directly to the ram of this Rockford "Hy-Draulic" slotter. Hydraulic table feeds operate in all directions

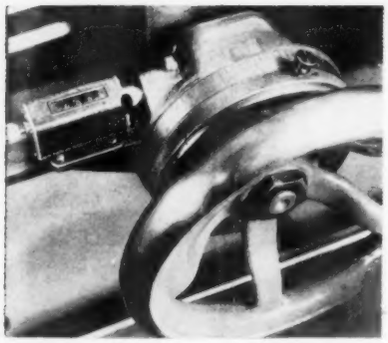
A.G.F. Convertible No. 89-C Forge

Convertible for use either as a bench forge or as an oven furnace for heat-treating operations, No. 89-C forge developed by American Gas Furnace Co., Elizabeth, N. J., can be equipped with separate turbo blower where a low pressure air supply is not available. When used for forging, this unit has entrances at both ends, measuring 6-in. wide by 2½-in. high and the banded brick cover can be removed.

For heat treating, this forge is converted to an oven by a special top brick, hearth slab and supports as shown. End bricks are provided to form a semi-muffle type heating chamber measuring 4½-in. wide, 6-in. long and 2¾ in. high. It is claimed that welding heats can be obtained in 25-30 min.

L&S Direct-Reading Lathe Attachments

Direct-reading measuring attachments, consisting of combined micrometer dial and counter arrangements have been developed by the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, for mounting on all sizes of standard Lodge & Shipley lathes ranging from 12 to 36-in. in size. The length measuring attachment shown has a dial graduated in 100 divisions and geared to a sleeve on the apron handwheel shaft so that

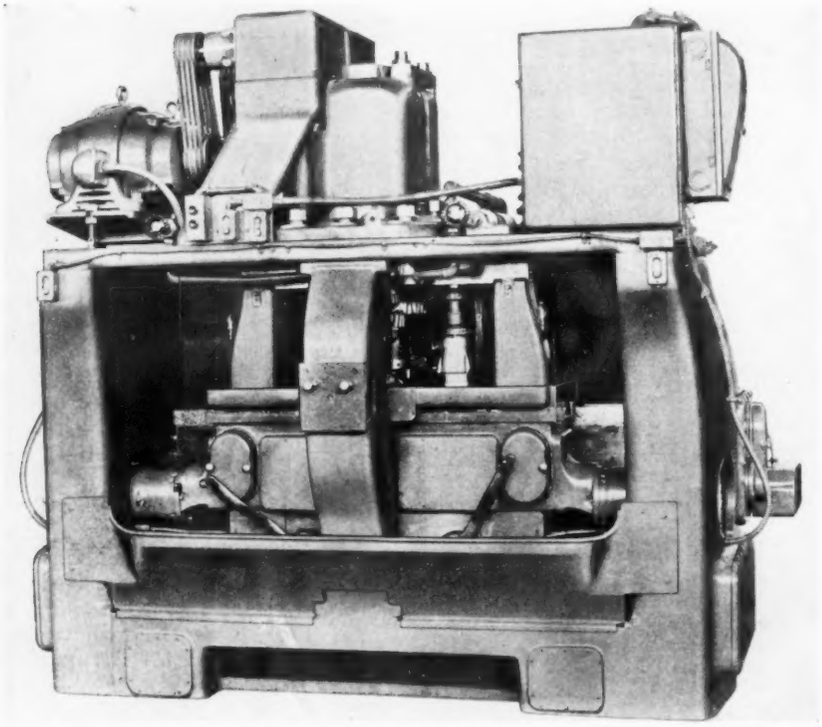


one complete turn of the dial represents 1-in. of carriage travel. The counter has four columns of figures and is geared to the micrometer dial so that the numeral in the right-hand column changes for each 0.10 in. of carriage travel.

A similar unit mounted on the cross slide feed screw replaces the regular micrometer ball stop. The micrometer dial of this unit is divided into four equal sections, since each quarter turn of the 5-pitch cross-feed screw changes the diameter of the work 0.1-in. Each section has 100 graduations, therefore each graduation represents 0.001 in. on the diameter. The counter has three columns of numerals and is geared to the dial in the proper ratio so that the number in the right-hand column changes for each 0.10 in. on the diameter.

Transmission gear unit being turned with inserted-blade cutters on the "RotoMill" unit. Finished piece is shown on bed between the two work spindles

National "RotoMill" For Turning



Cutter spindles on the "RotoMill" machine announced by National Broach & Machine Company are supported by the center brace. Inserted-tooth of milling cutters replace single-end tools for turning operations on this unit

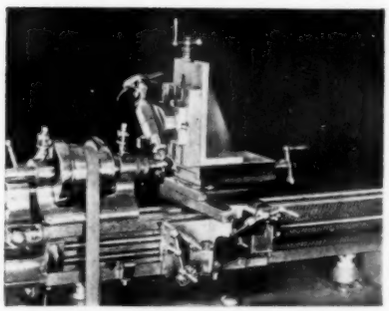
Milling cutters are used in place of standard single-end cutting tools in the "RotoMill" developed by National Broach & Machine Co., 11457 Shoemaker St., Detroit, Mich. for all types of cylindrical, conical or flanged-work turning. It is claimed that any turning operation normally handled on a lathe or screw machine can be done to an indicator limit of 0.004 in. at all points. Any cut can be cleaned up by removal of not more than 0.005 in. on the diameter.

Round or conical work up to and including 3-in. diameters when cut by duplicate opposed cutters on a 185-deg. rotary cycle are turned out at a rate of one every 25 sec. with an accuracy of 0.004 in. indicator readings. It is claimed that the work piece at the end of the cycle is only slightly warm and the chips show little heat discoloration.

The "RotoMill" uses large diameter milling cutters, each having from 50 to 100 teeth. Design and arrangement of cutters is such that the cutter load on the work piece is balanced; that is, cutter load on one side of the work piece is equalized by similar load diametrically opposite. Essentially, this machine consists of a reciprocating table which carries a vertical work spindle on each end and two vertical, centrally-located cutter spindles, one at each side of the table. The table carrying the work spindle, moving from the loading position, rapidly approaches the cutter spindles. Rate of table travel then is automatically retarded as actual cutting begins. As soon as the work spindle has reached a point in the plane between the cutter spindle centers, it starts to rotate and continues rotating through either 185 or 370 deg., depending on the nature of the operation. When the rotation limit has been reached, the table rapidly returns to its initial position where the work is unloaded and a new piece loaded.

Rivett Bench Lathe Milling Attachment

A carriage milling attachment, having vertical travel of $4\frac{3}{4}$-in., longitudinal hand-feed travel of $2\frac{7}{16}$-in. and power or hand cross feed of $8\frac{1}{16}$-in. is offered by Rivett Lathe & Grinder, Inc., 20 Riverview Road, Brighton, Boston, Mass., for use with the No. 608 bench lathe. It mounts on the saddle in place of the regular slide rack and longitudinal power feed is by carriage travel. Power cross feed is secured from the cross feed gear in the lathe carriage. Knee is fitted with a vertically-fed slide having T-slot for positioning the top swivel in which mounts the milling

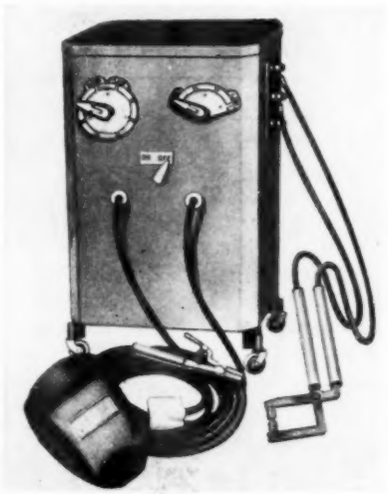


spindle. Work can be clamped on the vertical slide in place of the milling head, so that milling or boring operations can be performed with the tool held in the spindle of the lathe.

The No. 608 lathe has been improved by the addition of a safety interlock which prevents simultaneous engagement of the lead screw and feed rod and by providing four wipers on the carriage to clean automatically the bearing surfaces of the bed. This lathe is guaranteed to turn or bore within 0.001 in. in 6 in. when the work is held in a collet and to turn between centers within 0.0001 in. in 6 in. It will face 8 in. diameters within a limit of 0.0002 in. concave and 0.0000 in convex.

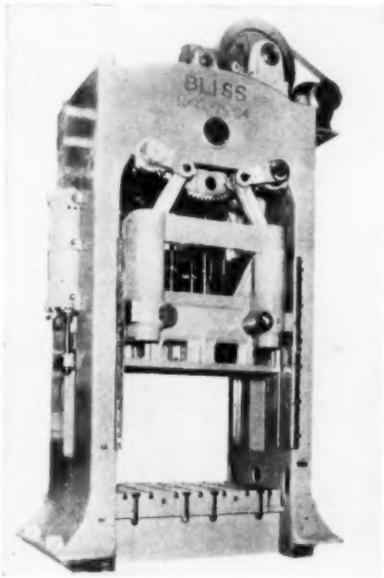
Miller Combination Arc and Spot Welder

Built in capacities of 165 and 220 amp., these combination arc and spot welders announced by Miller Electric Mfg. Co., Appleton, Wis., are designed to handle electrodes from $\frac{1}{16}$ to $\frac{1}{4}$ in. diameter. The units have 32 heat-control points, permitting the operator to weld from the lightest to the heaviest metal. Spot-welder unit will handle all types of sheet metal work.



Bliss No. 4L-7½-84 Single-Action Press

Developed by the E. W. Bliss Co., 53rd St. and Second Ave., Brooklyn, N. Y., this No. 4L-7½-84 point, single-action press, is particularly suitable for blanking and shallow forming operations. Opposed-motion rockshafts are featured in the design of this press and impart an opposed motion to the levers by means of eccentrics. This motion draws the slide up and then pushes it down for the working portion of the stroke. Any tendency of the slide to tilt while subject to unbalanced loads is said to be prevented by this arrangement. Outer main links straddle the outer web of the crown, thereby transmitting the load as a direct thrust through the web. Due to the linkage, a slight dwell of the bottom of the stroke is obtained, which is desirable in connection with drawing work.



Electrically controlled by push buttons for inching and running, the press operates at a speed of 15 strokes per min. and has a capacity of 250 tons at bottom stroke. Clutch is of the multiple-disk pneumatic type and incorporates both clutch and brake in one unit. The drive is by V-belts. Press has a 16-in. stroke with 20-in. adjustment of the slide by a reversible electric motor. Die space is 48 in., with stroke down and adjustment up. Bed area is 50x84 in., front to back by right to left. Incorporated in a bed is a self-contained, externally guided "Marquette" pneumatic cushion which will give 22.6 tons blankholding pressure. Counter-balance cylinders, which compensate for the weight of the slide, are mounted in the uprights.

Brown & Sharpe No. 000 Plain Miller

An automatic milling cycle, with rapid advance and return of the table, is featured in the No. 000 plain milling machine announced by Brown & Sharpe Mfg. Co., Providence, R. I. Designed specifically for the economical, rapid production milling of small pieces such as parts for sewing machines, firearms, electrical apparatus and business machines, this machine has broad, independent ranges of speed and feed to enable it to handle efficiently a wide variety of materials.

Sixteen rates of feed are provided, ranging from $\frac{9}{16}$ to $24\frac{3}{8}$ in. per min. Any desired rate is obtained from the front of the table by means of change gears. Table has a longitudinal movement of 4 in. A touch of a control button starts the automatic cycle of table movement; and, on completion of the cycle, the table stops in the loading position.

Fast travel forward at 365 in. per min. is engaged when the table is started. The single table dog engages cutting feed within an accuracy of $\frac{1}{16}$-in., reducing non-cutting time to the minimum. On completion of the cutting feed, fast travel of 737 in. per min. is engaged automatically to return the table to loading position.

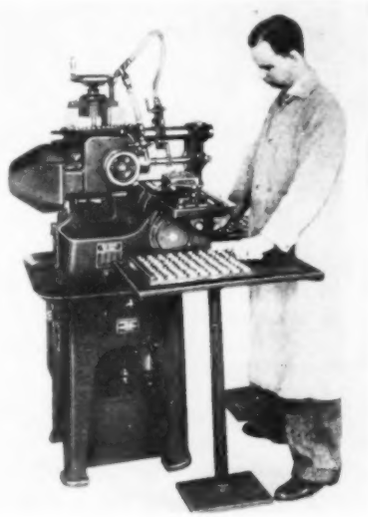


Table reversal is accurate to 0.002 in. Spindle is carried in a sleeve mounted in the head, and has a vertical adjustment of 6 in. and a transverse adjustment of 2 in. Machine is furnished with either of two spindle speed ranges: 160 to 3,540 r.p.m., or 107 to 2,340 r.p.m. Spindle drive is by V-belt and cone pulleys, either direct or through reduction gears, giving a range of 16 speeds.

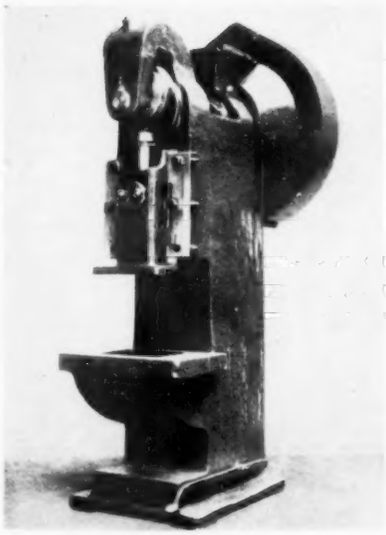
Doall Model ML Contour Machine

Openings in metal for dies and irregular shaped punches can be made by contour sawing and filing with the Model ML "Doall" contour machine offered by Continental Machine Specialties, Inc., 1301 Washington Ave. S., Minneapolis, Minn. Wheels for

the saws and file bands are 16-in. in diameter. Heavy-duty, screw-feed attachment is provided for use where the type of cut permits. An illuminated automatic butt welder for joining the saws is mounted on the column of the machine. This model accommodates work 10-in. thick, and has a 16-in. throat depth. Adjustable work table measures 24 x 24 in.

Ferracute Improved Punch Presses

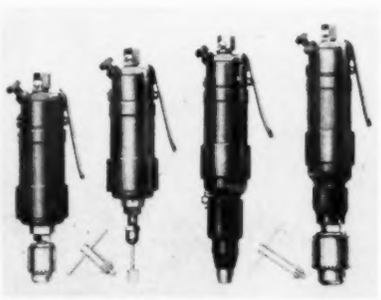
Ferracute Machine Co., Bridgeton, N. J., has announced an improved line of punch presses equipped either with direct or V-belt drive. Frames are of high-quality steel and are designed to give maximum strength with a minimum of deflection. Rams are extra long and ram bearings are bronze lined. The press shown has the following specifications: Stroke, 5 in.; stroke adjustment, 3 in.; shut height from bed to slide, 14 in.;



diameter of crankshaft at bearings, $5\frac{1}{2}$ in.; size of bed, $22\frac{1}{2}$ by 38 in. Shaft is supported by an overhanging bearing which forms a part of the frame casting.

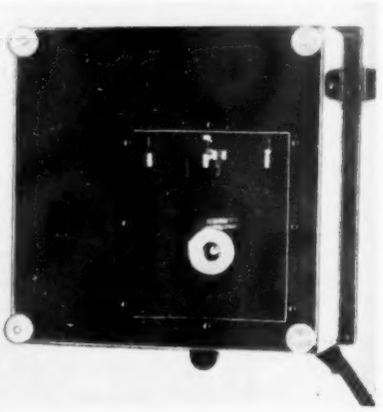
Cleco No. 9 Series Portable Air Tools

No. 9 Series pneumatic "Cleco" drills, grinders, screwdrivers and nut setters offered by The Cleveland Pneumatic Tool Co., 3738 E. 78th St., Cleveland, Ohio, weigh less than 2 lb. each. The drill has a speed of 2,100 r.p.m. and has a capacity of $\frac{1}{8}$ in. in steel. The grinder takes $\frac{3}{4}$-in. mounted wheels and operates at 20,000 r.p.m. Nut setter is supplied with a shank to take snap-on chucks with $\frac{9}{32}$-in. square drive hole. Standard equipment with the screwdriver is a $\frac{3}{16}$ in. bit with finder. This unit will drive No. 8 to 12 machine screws.



Bristol Air-Operated Cycle Controller

A single-cam cycle controller that provides for the ocntrol of as many as four separate operations is offered by the Bristol Co., S. Main St., Waterbury, Conn. The cam is designed to be cut so that it will meet a wide variety of requirements. Additional flexibility is provided through the use of adjustable segments. These instruments also have a mechanism which makes it possible to obtain two different speeds of rotation before the cam completes a cycle.



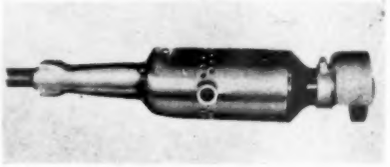
Lincoln Carbide Thread Plug Gages

Thread plug gages of cemented-carbides with the threads ground from the solid are offered by the

Lincoln Park Tool & Gage Co., Lincoln Park, Mich. The largest gage shown is $1\frac{15}{32}$ in. in diameter and has 50 pitch threads. The smaller gage measures $\frac{1}{2}$-in. in diameter and has 44 pitch threads. Both larger and smaller sizes can be made to very close tolerances.

B & D High-Speed Portable Grinders

Two high-speed portable grinders with wheel size capacities of 2 and $2\frac{1}{2}$ in. have been announced by the Black & Decker Mfg. Co., Towson, Md. These precision tools have a no-



FROM KITCHEN SCALES TO HELMETS—

Plastics Headquarters Aids Design and Production

Handsome housings for kitchen scales and many other products are made from Bakelite Molded.

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THE VARIETY of manufactured products now made to advantage with Bakelite plastics is practically unlimited. Bakelite Plastics Headquarters offers so many different materials for your selection, that articles as widely dissimilar as kitchen scales and construction helmets . . . or toy whistles and oil-well valves . . . are improved through their use.

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Whenever you are considering the use of plastics, consult Bakelite Plastics Headquarters *first.* There you will obtain the benefit of unbiased, impartial engineering service, assuring you maximum benefits in design and production. Write for Portfolio 4 of reference data.

BAKELITE CORPORATION, 247 PARK AVENUE, NEW YORK, N.Y.

BAKELITE CORPORATION OF CANADA, LIMITED, 163 Dufferin Street, Toronto, Canada *West Coast:* Electrical Specialty Co., Inc., Los Angeles and San Francisco, Cal.

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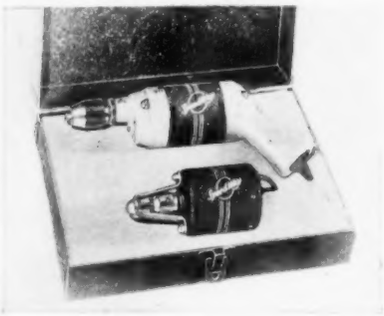
PLASTICS HEADQUARTERS

load speed of 19,000 r.p.m., an over-all length of 13½ in., and a weight of 3½ and 4½ lb. respectively.

Speedway No. 250 Drill and Grinder

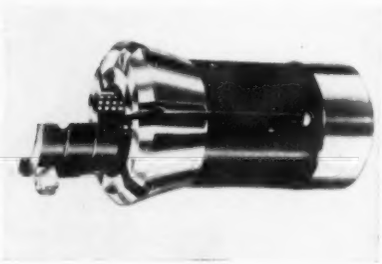
Incorporating the No. 69 electric drill and the No. 129 grinder, the No. 250 drill and grinder kit offered by Speedway Mfg. Co., 1834 S. 52nd



Ave., Cicero, Ill., is available for light-duty intermittent work on a variety of materials. The drill operates at 1,000 r.p.m. and has a capacity for ¼-in. in steel. Grinder operates at 20,000 r.p.m. Case for this kit measures by 8x10x4 in. A combination stand for bench operations also is available.

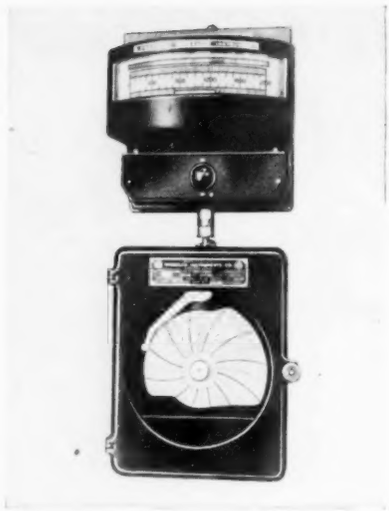
Modern "Martin" Master Collet

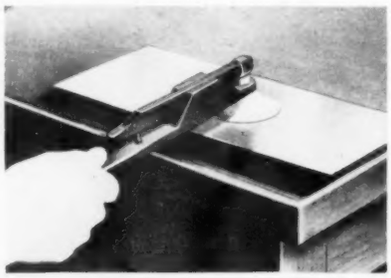
"Martin" master collet announced by the Modern Collet & Machine Co., Ecorse, Mich., features pads which are held in place by screws that are integral parts of the locking wedges in the end of the collet. When it is necessary to change the pad a few turns of the wedge screws permit quick removal, with the collet still in the operating position in the machine.



Wheelco Variable Program Control

A program unit and a standard controller mounted integrally comprises the program unit for variable temperature control offered by Wheelco Instruments Co., 1929 S. Holsted St., Chicago, Ill. To the temperature control setting pointer of the Capacitrol controller is attached an idler arm which rides on the edge of the contoured disk of the program unit. Program disk is rotated by synchronous motor through a gear reduction.



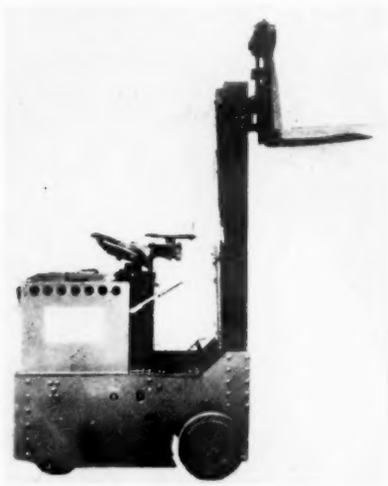


"Ipco" Safety Vacuum Lifter

Developed especially for feeding parts to dies in punch press operations, the "Safety" vacuum lifter announced by Industrial Products Co., 704 W. Somerset St., Philadelphia, Pa., releases instantly when the vacuum is broken by the operator. In use, the lifter is grasped firmly and struck sharply against the sheet or blank. This produces a vacuum within the cup. The lever is depressed to unseat the valve and break the vacuum.

W.-H. "Bantam" Small Electric Truck

Over-all length of the "Bantam" center-control power fork truck announced by Wright-Hibbard Industrial Electric Truck Co., Inc., Phelps, N. Y., is 72 in. with 24-in. long forks. Over-all width of truck is 26 in. With a 90 deg. swing of trailing wheels, truck will turn in a complete circle of 94. in diameter, thus permitting operation in a 42-in. wide intersecting aisle. Normal capacity is 1,000 lb. on the forks; this can be increased by increasing the over-all length of the truck.



Curran Portable Coolant System

Improvements in the portable coolant system developed by the Curran Machine Works, 31-25 Forty-Fifth St., Long Island City, N. Y., include means for returning the coolant liquid to the well of the pump. This permits re-use of the coolant and aids in keeping the work-place clean. Being foot-operated, this pump unit permits the workman to use both hands in productive work.

Westinghouse Ignitron Spot Welding Timer

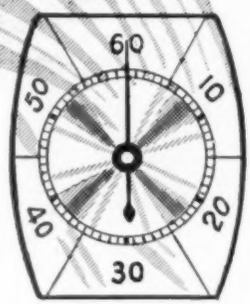
Type SP-11 "Ignitron" spot welding timer announced by Westinghouse Electric & Mfg. Co., East Pittsburgh,

Always Consider Resistance Welding

THINK OF WELDING

10 TO 20 SPOTS PER SECOND

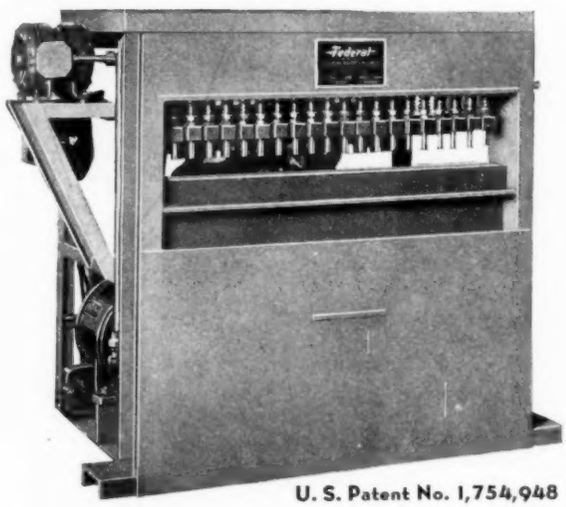
Five Times Faster Than Ever Before



Not just a hope . . . or a dream . . . but an actuality . . . an amazing accomplishment now made possible and practical by the new ULTRA-SPEED SPOT WELDING method being introduced to important fabricating industries by The Federal Machine and Welder Company.

Not only has this revolutionary, hi-production spot welding method increased production speed to five times former capacity records, but it has simultaneously simplified operation, raised efficiency and lowered costs.

ULTRA-SPEED Welds are cleaner and of greater strength and uniformity than ever before obtained in production welding. Transformer capacity is small because only one electrode welds at a time. From ten to several hundred electrodes may be incorporated in a single machine, making the number of spot welds practically unlimited. Panels are held in perfect shape as individual electrodes act as hold-down clamps and, to a certain extent, as forming dies. In addition, ULTRA-SPEED Spot Welders are of simple construction, requiring a minimum of maintenance.



U. S. Patent No. 1,754,948

This illustration shows a small ULTRA-SPEED Spot Welding Machine for making a single row of 20 spots. The electrodes are spring loaded. Pressure is supplied by a hydraulic cylinder and pumping unit mounted below. Secondary switch is mounted in back of electrodes.

Its application covers a wide field including automobile bodies, chassis, parts and accessories; steel house assemblies; metal furniture; stoves; refrigerators; air conditioning units; airplane parts; railroad car parts, wire mesh, wire racks and other assembly work requiring a number of spots.

Descriptive literature is available. Write for it. Federal ULTRA-SPEED Spot Welders are the most revolutionary advancement in the resistance welding equipment industry and offer unlimited possibilities to progressive manufacturers everywhere.

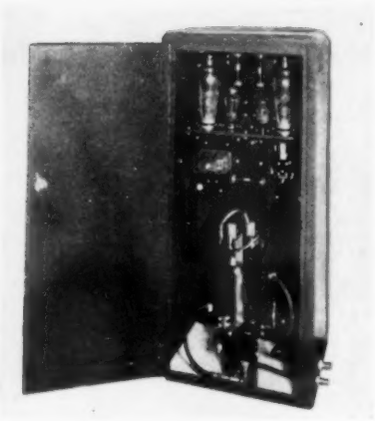
the Federal FEDERAL

MACHINE & WELDER CO.

In England, made by British Federal Welder & Machine Co. Ltd., Dudley, England

WARREN, OHIO

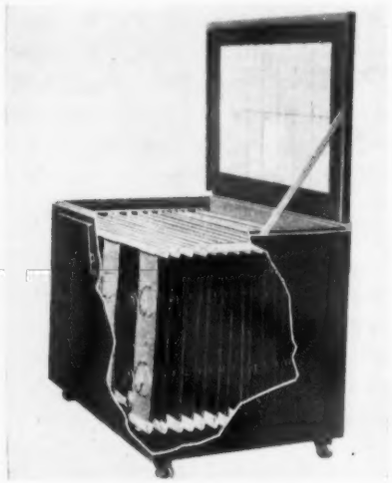
SALES OFFICES IN ALL PRINCIPAL CITIES



Pa., mounts two sizes of ignitron tubes. On low-duty cycles, the WL-652 tube will carry 1,500 amp. at 220, 440 or 550 volts, while the WL-651 tube will carry 2,800 amp. at 440 and 550 volts or 4,300 amp. at 220 volts. These timers are adjustable to pass current for any exact number of cycles from 1 to 15. For longer times, the Model SP-11-A timer is available for from 1 to 30 cycles.

Art Metal "Planfile"

Various kinds and sizes of drawings can be kept in the "Planfile" offered by Art Metal Construction Co., Jamestown, N. Y. From 3,000 to



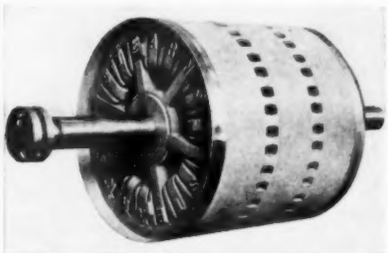
5,000 separate sheets can be filed between spring compressors that hold the drawings in place and protect them against wear and tear. A visible index is exposed automatically when the cover is raised.

"Service" Hydraulic Hand-Lift Truck

Service Caster & Truck Co., 635N Brownswood Ave., Albion, Mich., has developed an improved lift truck in which twin roller chains, attached to double hydraulic pumps, lift the platform. Load automatically is locked at any height of lift. Adjustment of a foot pedal control frees the handle at any point of lift or lowers the load hydraulically. Truck is made in four capacities of 2,500, 3,500, 5,000 and 6,000 lb., or is custom-built for any capacity to 10,000 lb.

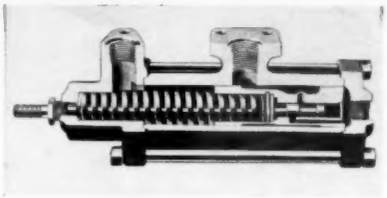
Stearns Improved Magnetic Pulley

High-duty magnetic pulleys offered by the Stearns Magnetic Mfg. Co., Milwaukee, Wis., have been improved through the development of a new ribbed construction designed to permit more ampere-turns with subsequent increased magnetic strength. The system of air ducts also has been improved to provide an increased cooling area around the coil winding.



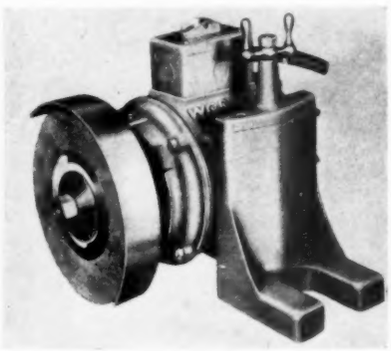
Morin Hydraulic Control Valve

Fluid pressure may be applied smoothly and gradually from zero to a desired maximum by small increments with the hydraulic pressure control valve developed by the Morin Mfg. Co., Holyoke, Mass. Design of the valve provides for the maintenance of a selected pressure, irrespective of conditions which tend to diminish or increase the pressure in the power applying mechanism.



Wodack Angle-Plate Grinding Heads

Available with or without the vertical feed arrangement shown, these angle-plate grinders announced by Wodack Electric Tool Corp., 4627–29 W. Huron St., Chicago, Ill., are equipped with an 8 x $\frac{3}{4}$-in. grinding wheel, wheel guard, and tooth rest. The unit also can be arranged with a horizontal feed. Plain unit has a bolt arrangement for adjusting the wheel to the work center.



"Esico" Thermostatic Soldering Iron Stand

Soldering iron temperatures can be obtained at any desired point with the thermostatically controlled stand offered by Electric Soldering Iron Co., Inc., Deep River, Conn. Available in two sizes, these units are said to maintain the temperature of the iron while on the stand and to apply full current to the iron when it is removed for work.

Barkon-Frink Lighting Fixture

Fluorescent lumiline lamp fixtures for color examination and general inspection work are offered by Barkon-Frink Tube Lighting Corp., 23-10 Bridge Plaza South, Long Island City, N. Y.

The Model FB-324 fixture uses three 24-in. daylight fluorescent tubes which are claimed to produce light which approximates closely that of daylight and is suitable for color grading. Complete unit measures 4¼x11½x28 in. and it can be operated on 110 or 220 volt circuits.

Smootharc "Har-Ten" Welding Electrode

Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis., offers the Smootharc "Har-Ten" welding electrode for alloy steel welding. Base metal of this electrode contains alloying elements which precipitate from solid solution at certain temperatures, thereby increasing hardness and ultimate strength. There are two types: Type A is used for flat, vertical and overhead positions, while Type B is for flat work only. Both are available from ⅛ to ¼ in. in diameter in 14-in. lengths.

TRADE PUBLICATIONS

ARC WELDING A 24-page bulletin announced by Hobart Bros., Canal Lock Square, Troy, Ohio, discusses the feature of "Multi-Range" arc welders and describes various styles in detail.

BENCH PRESSES Bulletin No. 59-D, being distributed by Niagara Machine & Tool Works, 637–697 Northland Ave., Buffalo, N. Y., discusses the features of No. 101 bench-type power presses.

BITS AND SHANKS Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill., has issued a 24-page catalog, No. 70, which gives specifications on bits for driving slotted head and Phillips recess-head screws and on socket wrench shanks and socket wrenches for use with all models of Thor and other makes of power screw drivers and nut setters.

BROACHING Need for careful engineering in broach design is discussed in a bulletin recently published by National Broach & Machine Co., Shoemaker & St. Jean St., Detroit, Mich.

CASTERS Catalog No. 53-32, announced by the Fairbanks Co., 393 Lafayette St., New York, N. Y., lists and describes casters for practically every purpose.

CAST IRON The International Nickel Co., Inc., 67 Wall St., New York, N. Y., has issued a 1938 revision of data sheets covering compositions and service data on industrial applications of nickel cast iron.

CHAIN HOISTS Catalog No. 38, issued by the Ford Chain Block Div., American Chain & Cable Co., Inc., Philadelphia, Pa., lists the regular line of spur gears, screw and differential chain hoists as well as jib cranes and new differential hoists with ball bearing mountings.

CHECK VALVES Crane Co., 836 S. Michigan Ave., Chicago, Ill., has published an eight-page booklet entitled "Checking Up on Check Valves."

COMPRESSED AIR "Air Tight" is the title of a 12-page bulletin discussing air line economies offered by A. Schrader's Son Div., Scovill Mfg. Co., Inc., P. O. Box 240, Brooklyn, N. Y.

CONTOUR SAWING Information on filing and sawing speeds with the

The TRANSPARENT SOLUTIONS
MADE POSSIBLE BY
"Stuart's CODOL"
Liquid Grinding Compound
INSURE BETTER WORKMANSHIP
Phone or write today for Free Working Sample and 24 page booklet describing this highly recommended modern grinding lubricant.
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"Doall" contour machine is given in an illustrated folder prepared by the Continental Machine Specialties, Inc., 1301 Washington Ave. S., Minneapolis, Minn.

CUTTING SERVICE Joseph T. Ryerson & Son, Inc., 16th and Rockwell St., Chicago, Ill., is distributing a four-page bulletin discussing the Ryerson flame cutting service for supplying cut sections and parts from rolled steel.

COPPER Reprints of an address on "Copper and Copper Alloys" by M. G. Steele are being distributed by Revere Copper and Brass, Inc., 230 Park Ave., New York, N. Y. Included in this reprint is a large chart giving useful information on 30 alloys.

ELECTRIC PRODUCTS The Trumbull Electric Mfg. Co., Plainville, Conn., has announced publication of the July, 1938, issue of the "Trumbullist," a catalog that will be issued every six months.

CUTTING & WELDING General Welding & Equipment Co., 292 Main St., Cambridge, Mass., is distributing a 7-page folder in which are described a number of standard "Geweco" welding and cutting torches and pressure regulators.

ELECTRODES A pocket-size pamplet discussing the features of "Murex" welding rods has been announced by Metal & Thermit Corp., 120 Broadway, New York, N. Y.

FORGINGS AND CASTINGS "FCC Products and Services" is the title of a 64-page catalog issued by the Forging and Casting Corp., Ferndale, Detroit, Mich.

GALVANIZING The Wallace G. Imhoff Co., Vineland, N. J., has published a "Bibliography of Techincal Articles" written by Wallace G. Imhoff and published in various industrial magazines.

GROUND SHAFTING A four-page bulletin discussing methods used in the production of ground shafting has been published by Bliss & Laughlin, Inc., Harvey, Ill.

GRINDERS A catalog discussing the features of 10, 14 and 16-in. type D plain hydraulic grinders has been announced by Landis Tool Co., Waynesboro, Pa. This fully illustrated bulletin is listed as Catalog No. C-38.

LEATHER BELTS J. E. Rhoades & Sons, 35 N. Sixth St., Philadelphia, Pa. is distributing a folder in which are discussed features of "Tannate" leather belts.

LIFT TRUCK Bulletin No. A-8330, offered by the Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland, Ohio, describes the Type E-1 high lift platform truck and includes illustrations showing typical applications using various attachments.

MILLER Bulletin No. M-796, recently published by the Cincinnati Milling Machine and Cincinnati Grinders, Inc., Cincinnati, Ohio, is entitled "Cincinnati Vertical Hydro-Tel Milling Machine" and discusses the features of this standard unit which can be used for conventional milling and for die sinking operations.

NITRIDING "Homo Method for Nitriding" is the title of a 16-page bulletin recently issued by the Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Profusely illustrated, this bulletin includes graphs showing the effects of time and temperature.

OPERATION RECORDERS Bulletin No. 510, published by the Bristol Co., Waterbury, Conn., describes a

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PORTABLE TOOLS Catalog No. 40, announced by Skilsaw, Inc., 230 N. Michigan Ave., Chicago, Ill., discusses the features of a complete line of portable electric saws, drills, sanders and grinders.

PYROMETERS "Pyromaster" potentiometer pyrometers for automatic control of furnace, oven and kiln temperatures are described in a mailing folder, Bulletin No. 516, now being distributed by The Bristol Co., Waterbury, Conn.

SPEED-REDUCER MOTORS Bulletin No. 1022, issued by Bodine Electric Co., 2264 W. Ohio St., Chicago, Ill., illustrates and describes more than 60 types of small motors equipped with worm-gear speed reducers, ranging from 1/400 to 1/6 hp. with drive shaft speeds of from 1 to 300 r.p.m.

STEAM TURBINES Bulletin No. B-2137, offered by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., discusses the features of Type C general-purpose steam turbines with capacities ranging from 5 to 500 hp. at speeds of 1,000 to 5,000 r.p.m.

STEELS Ludlum Steel Co., Watervliet, N. Y., has published a catalog entitled "Fine Steels by Ludlum," in which are discussed the characteristics and applications of a number of tool, stainless, carbon and alloy steel products.

SURFACE GRINDING "Work Done on the Blanchard" is the title of a booklet now being distributed by the Blanchard Machine Co., 64 State St., Cambridge, Mass. It contains more than 100 examples with production data of work done on Blanchard surface grinders.

SYMBOL CHART A 26x35 in. chart of hard-to-find symbols used by architects and engineers is being distributed by the Frederick Post Co., Box 803, Chicago, Ill. Copies of this chart, which shows 249 symbols, are being distributed free to architects, engineers and users of drafting room supplies.

TANTALUM CARBIDE TOOLS "Vascoloy-Ramet Tantalum Carbide Tools and Blanks" is the title of a 12-page catalog and price list of standard tools and blanks announced by Vascoloy-Ramet Corp., North Chicago, Ill.

TRACTOR MANUAL The "Graham-Bradley Tractor Shop Manual" issued by Graham-Paige Motors Corp., Detroit, Mich., gives considerable information regarding the maintenance of Model 503.93 and 503.103 tractors of the general purpose and four-wheel standard types.

THERMIT WELDING A 34-page booklet describing the Thermit welding process and its applications is offered by Metal & Thermit Corp., 120 Broadway, New York, N. Y.

TOOL STEELS Four bulletins discussing the properties of "Swed-Oil," "Hi-Run," "D-C-22," and "D-C-66" tool steels are offered by the Kloster Steel Corp., Justine and Fulton Sts., Chicago, Ill.

TIME SWITCHES Type TSA-14 automatic time switches for control of a.c. or d.c. circuits are described in Bulletin GEA-2963 offered by General Electric Co., Schenectady, N. Y.

VARIABLE SPEED CONTROL Catalog No. G-384, announced by Reeves Pulley Co., Columbus, Ind., describes in detail variable speed transmissions, vari-speed motor pulleys and "Moto-

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includes photographs of typical installations.

VALVES Folder No. 179, offered by Jenkins Bros., 80 White St., New York, N. Y., discusses the features of a new line of bronze mounted and all-iron U-bolt gate valves.

WELDING ALUMINUM Aluminum Co. of America, Pittsburgh, Pa., has issued a revised edition of the booklet "Welding Aluminum." Fusion, torch, arc and resistance welding methods are discussed in considerable detail.

NEW BOOKS

ELECTRIC WELDING. *By Morgan H. Potter, instructor, general shops, The William Hood Dunwoody Industrial Institute.* 126 *pages,* 5½ x 8 *in. Illustrated. Clothboard binding. Published by the American Technical Society, Drexel Ave., at* 58th *St., Chicago. Price* $1.25.

Prepared for the apprentice or for the vocational school student, this book covers the principles and applications of the various types of electric arc welding. Among other things, it tells the student how to select and use a.c. and d.c. welding equipment and protective equipment. It shows how to prepare a job for welding, use of fixtures, and how to do flat welding, butt welding, lap welding and down welding. Arrangement of beads for various jobs is taken up, as well as methods of determining the weldability of various metals.

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STRENGTH OF MATERIALS. *By Norman C. Riggs, professor of mechanics, and Max M. Rocht, associate professor of mechanics, Carnegie Institute of Technology.* 446 pages, 4¾ x 8½ *in. Indexed and illustrated. Cloth board binding. Published by The Ronald Press Company,* 15 *East* 26th *St., New York, N. Y. Price* $3.75.

Primarily a textbook, this volume contains the essentials of a first course in strength of materials as given in engineering schools. Illustrative examples are worked out in the text with explanations as to the principles followed. An abundance of pratical problems is included.

Some features of the book depart from the conventional presentation of this subject. Included, for instance, is a brief introduction of the Hardy Cross method of moment distribution. Another feature is the introduction of the theory and application of photoelasticity to the study of stresses. Chapter 13 includes curves on factors of stress concentration because of the wide recognition of this cause of failure in fatigue.

The material upon which this volume has been based has been tested for five years in a classroom. The authors, who are well known for their activities and research in this subject, have found the contents of this volume to be particularly effective in teaching their course.

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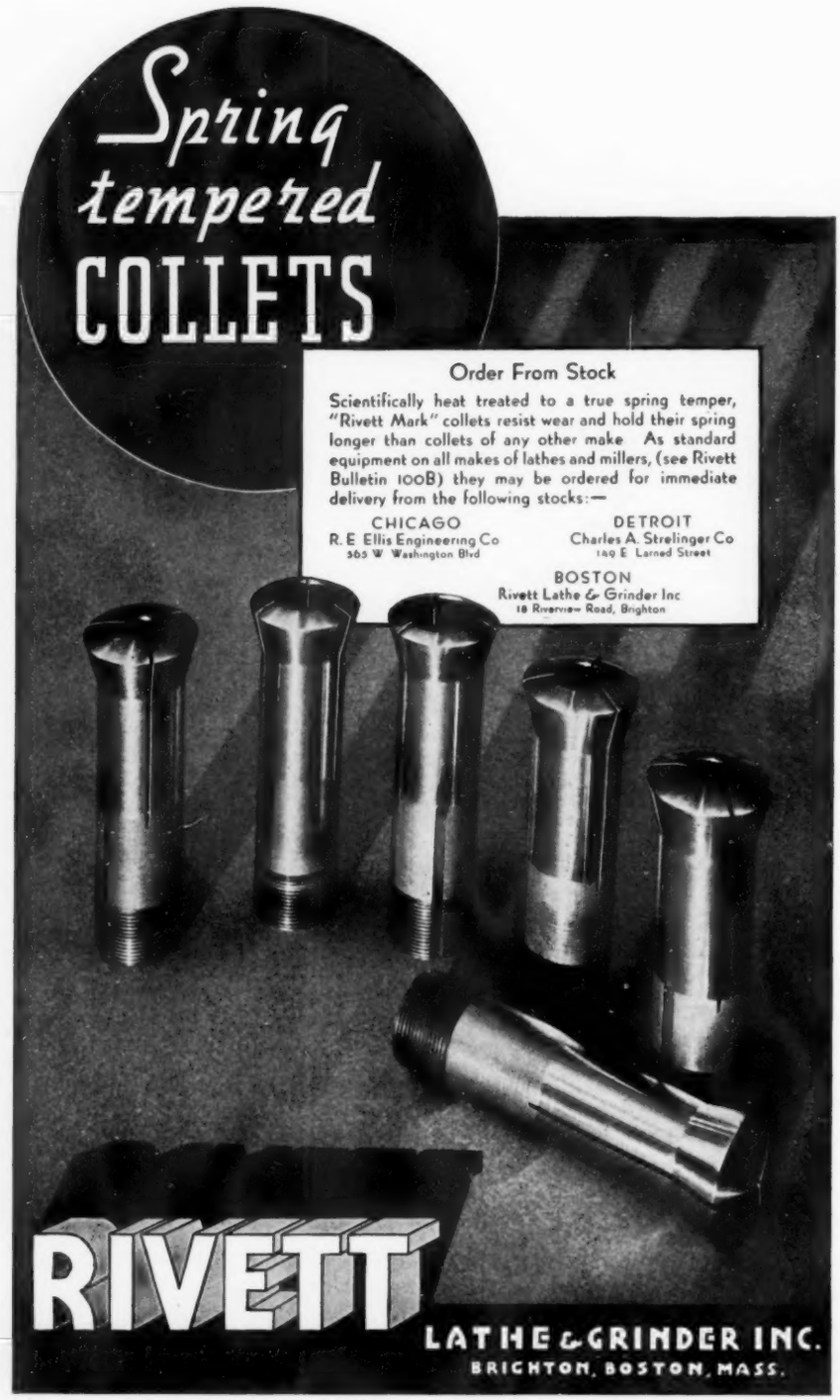
THE INTERNAL COMBUSTION ENGINE. *Vol. I. Second Edition. By D. R. Pye, Director of Scientific Research, Air Ministry, England. Published by the Oxford University Press,* 114 *Fifth Ave., New York, N. Y. Price,* $5.

Mr. Pye explains at the outset that this new edition is not extensively rewritten, but rather modified where essential to bring it up to date since the first edition in 1931. Detonation is an exception, being a new exposition of the subject in the light of recent research. Non-volatile liquid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fuels are also treated with respect to their combustion in the compression-ignition engine. Another revision is in the recalculation of combustion temperatures which reflect the most recent work on heat capacities and dissociation constants.

Otherwise the book remains what it was originally intended to be—a discussion of principles which underlie the design and operation of the engine. The book is, therefore, primarily for the student or the engineer before he has become immersed in the intricacies of manufacture.

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SEGMENTAL FUNCTIONS. *By C. K. Smoley.* 184 *pages,* 4½ x 7 *in. Flexible covers. Published by C. K. Smoley & Sons, Scranton, Pa. Price,* $5.

Segmental functions, which are understood to be a new mathematical entity, have been developed to facilitates calculations involving circular work. These functions accomplish for the solution of the circular segment what trigonometric functions have done for the solution of the triangle.

In a triangle there are six parts—three sides and three angles—and when three parts, one of which must be a side, are known, trigonometric functions may be used to compute the three unknown parts. In a segment there are five parts, (1) the arc, (2) the chord, (3) the radius, (4) the central angle subtended by the arc, and (5) the height, or middle ordinate referred to the chord as abscissa. When any two parts are known, the other three, and also the area, may be determined by means of segmental functions.

Work of this kind is simplified by using logarithms of the segmental functions instead of the functions themselves. The author has evolved a set of formulas adapted to logarithmic work, and all solutions can be handled by simple additions and subtractions.

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GROUP PURCHASE OF MEDICAL CARE BY INDUSTRIAL EMPLOYEES, *Report No.* 54 *prepared by Leahmae Brown, research assistant, Industrial Relations Section, Department of Economics and Social Institutions, Princeton University.* 53 *pages,* 7 x 10 *in. Paper bound. Published by Princeton University, Princeton, N. J. Price,* $1.00.

As pointed out by J. Douglas Brown, director of the Industrial Relations Section, in the foreword of this report: Unemployment, dependent old age, premature death and sickness long have threatened disaster to the industrial wage earner. Progress has been made in lifting the first three risks from the level where good luck as relief were the alternatives for great numbers of families. However, the disaster of disabling sickness still finds the wage earner unprepared.

Core of the sickness problem clearly is the financing of adequate medical care. Loss of earnings, while serious, definitely is secondary as a cause of distress. As a profession, medical practice has made great strides. However, as a social service, medical practice has been hampered. It is significant that a few of the more progressive industrial corporations have seen fit to facilitate methods of financing medical practice which broaden the social service rendered.

This report is intended as a brief summary and analysis of a limited number of plans for the group purchase of medical care by industrial employees. It is based on material collected during the past two years. The plans presented have been chosen as representative.

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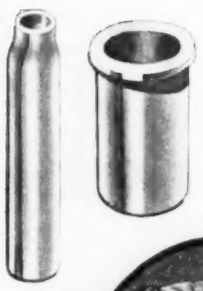

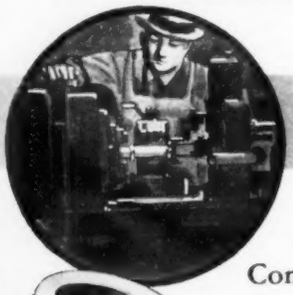

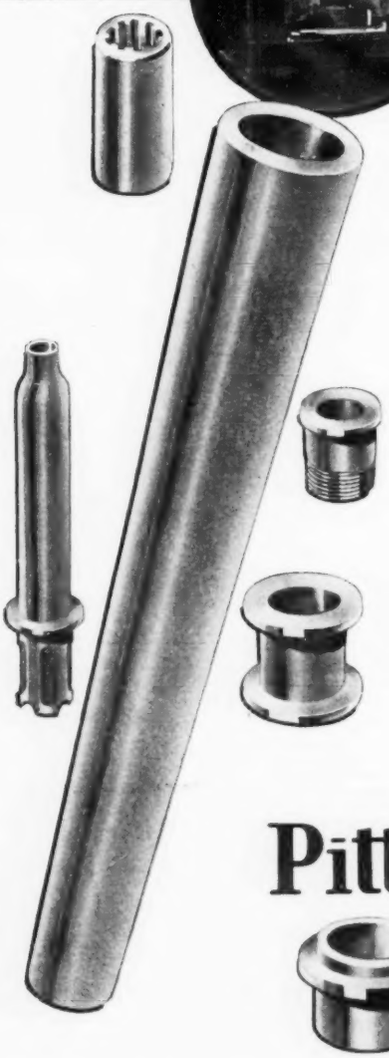

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